# FCC CFR47 PART 15 SUBPART E
# INDUSTRY CANADA RSS-210 ISSUE 7

## CERTIFICATION TEST REPORT

## FOR

## DC544D_2 PCIe DAUGHTER CARD FOR 2.4 / 5 GHz AP/ROUTER APPLICATIONS_DFS

**MODEL NUMBER: 65-VN780-P2**

**FCC ID: J9C-DC544D2**
**IC: 2723A-DC544D2**

**REPORT NUMBER: 09U12687-7**

**ISSUE DATE: OCTOBER 21, 2009**

*Prepared for*
**QUALCOMM, INC.**
**3165 KIFER ROAD**
**SANTA CLARA, CA 95051, U.S.A.**

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

NVLAP LAB CODE 200065-0

Revision History

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| -- | 10/21/09 | Initial Issue | F. Ibrahim |

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** QUALCOMM INC.
3165 KIFER RD
SANTA CLARA, CA 95051
U.S.A.

**EUT DESCRIPTION:** DC544D_2 PCIe DAUGHTER CARD FOR 2.4 / 5 GHz AP/ROUTER APPLICATIONS_DFS

**MODEL:** 65-VN780-P2

**SERIAL NUMBER:** 7916 for Antenna Port, 7929 for Radiated Emission, and 02324 for DFS

**DATE TESTED:** JUNE 24 – OCTOBER 15, 2009

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULTS** |
| CFR 47 Part 15 Subpart E | Pass |
| INDUSTRY CANADA RSS-210 Issue 7 Annex 9 | Pass |
| INDUSTRY CANADA RSS-GEN Issue 2 | Pass |

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

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

Approved & Released For CCS By:

FRANK IBRAHIM
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

Tested By:

VIEN TRAN
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, FCC 06-96, 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. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

## 4.3. MEASUREMENT UNCERTAINTY

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

| PARAMETER | UNCERTAINTY |
|---|---|
| Conducted Disturbance, 0.15 to 30 MHz | 3.52 dB |
| Radiated Disturbance, 30 to 1000 MHz | 4.94 dB |

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

# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

The EUT is an 802.11a/b/g/n WLAN transceiver module in a PCI form factor, for 2.4 / 5 GHz AP/Router Applications that include DFS bands. It is equipped with four identical transmitter / receiver chains.

The radio module is manufactured by Qualcomm, 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) |
|---|---|---|---|
| **5.2 GHz BAND** | | | |
| 5180 - 5240 | 802.11a | 12.18 | 16.52 |
| 5180 - 5240 | 802.11n HT20 | 13.23 | 21.04 |
| 5190 - 5230 | 802.11n HT40 | 16.67 | 46.45 |
| **5.3 GHz BAND** | | | |
| 5260 - 5320 | 802.11a | 19.15 | 82.22 |
| 5260 - 5320 | 802.11n HT20 | 20.65 | 116.14 |
| 5270 - 5310 | 802.11n HT40 | 23.24 | 210.86 |
| **5.6 GHz BAND** | | | |
| 5500 - 5700 | 802.11a | 19.88 | 97.27 |
| 5500 - 5700 | 802.11n HT20 | 20.24 | 105.68 |
| 5510 - 5670 | 802.11n HT40 | 23.80 | 239.88 |

## 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a dual band omni monopole (4 identical) antenna, each with a maximum gain of 3 dBi in the 5 GHz bands.

For the 802.11a legacy mode only two chains are transmitting, therefore the effective legacy antenna gain is:

| Antenna Gain (dBi) | 10 Log (# Tx Chains) (dB) | Effective Legacy Gain (dBi) |
|---|---|---|
| 3 | 3.01 | 6.01 |

## 5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Qualcomm, rev. 0.0.500.5.

The test utility software used during emissions testing was PTT Gui, rev. 5.1.

## 5.5. WORST-CASE CONFIGURATION AND MODE

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

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

802.11a Mode (20 MHz BW operation): 6 Mbps, OFDM.
802.11n MIMO HT20 Mode: MCS31, 260 Mbps, 4 Spatial Streams.
802.11n MIMO HT40 Mode: MCS31, 540 Mbps, 4 Spatial Streams.

Worst-case mode and channel used for 30-1000 MHz radiated and power line conducted emissions was the mode and channel with the highest output power, that was determined to be 11n HT40, high channel.

For bandwidth measurement preliminary testing showed that there is no significant difference among different chains, so the measurements were performed using Chain 0.

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

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

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

## 5.6. DESCRIPTION OF TEST SETUP

**SUPPORT EQUIPMENT**

| PERIPHERAL SUPPORT EQUIPMENT LIST | | | | |
|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Serial Number** | **FCC ID** |
| Laptop | IBM | T43 ThinkPad | L3-XDLXW06/02 | DoC |
| AC Adapter | IBM | 08K8204 | 11S08K8204Z1Z9 | DoC |
| DC Power Supply | Tektronic | PS2521G | N/A | N/A |
| DC Power Supply | HP | 336108 | KR24104150 | N/A |
| Extender PCI | ALLION | V1 EC-PEM V1.0 | A073 | N/A |

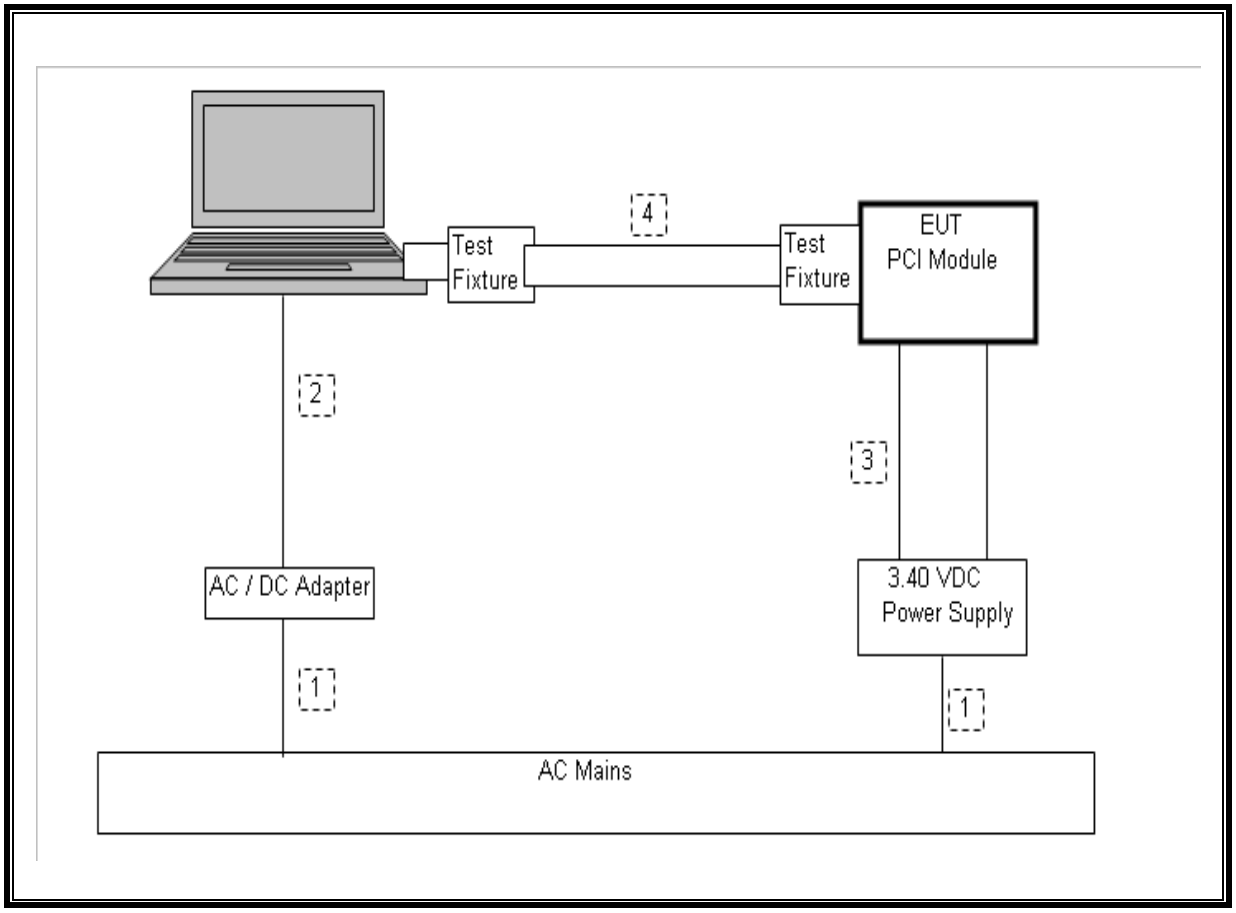
**I/O CABLES**

| I/O CABLE LIST | | | | | | |
|---|---|---|---|---|---|---|
| **Cable No.** | **Port** | **# of Identical Ports** | **Connecto Type** | **Cable Type** | **Cable Length** | **Remarks** |
| 1 | AC | 2 | US115 | Un-shielded | 1.5 m | For laptop |
| 2 | DC | 1 | DC | Un-shielded | 1.5 m | For laptop |
| 3 | DC | 1 | Cable | Un-shielded | 1.0 m | For EUT |
| 4 | Ribbon | 1 | Ribbon | Un-shielded | .4 m | Test Fixture |

**TEST SETUP**

The EUT is connected to a host laptop computer via a test fixture during the tests. Test software exercised the radio card.

**SETUP DIAGRAM FOR TESTS**



# 6. TEST AND MEASUREMENT EQUIPMENT

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

| TEST EQUIPMENT LIST | | | | | |
|---|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Asset** | **Cal Date** | **Cal Due** |
| Spectrum Analyzer, 44 GHz | Agilent / HP | E4446A | C01069 | 01/05/09 | 01/05/10 |
| Antenna, Bilog, 2 GHz | Sunol Sciences | JB1 | C01011 | 01/14/09 | 01/14/10 |
| Antenna, Horn, 18 GHz | EMCO | 3115 | C00945 | 04/22/09 | 04/22/10 |
| Antenna, Horn, 26.5 GHz | ARA | MWH-1826/B | C00589 | 09/29/08 | 11/28/09 |
| Antenna, Horn, 40 GHz | ARA | MWH-2640B | C00981 | 05/21/09 | 05/21/10 |
| Preamplifier, 40 GHz | Miteq | NSP4000-SP2 | C00990 | 10/11/08 | 10/11/09 |
| Preamplifier, 1300 MHz | Agilent / HP | 8447D | C00885 | 03/31/09 | 03/31/10 |
| Preamplifier, 1-26GHz | Agilent / HP | 8449B | C01052 | 08/05/08 | 08/05/09 |
| Peak Power Meter | Boonton | 4541 | C01186 | 01/19/09 | 01/19/10 |
| Peak Power Sensor | Boonton | 4541 | C01189 | 01/15/09 | 01/15/10 |
| LISN, 30 MHz | FCC | LISN-50/250-25-2 | N02625 | 10/29/08 | 10/29/09 |
| EMI Test Receiver, 30 MHz | R & S | ESHS 20 | N02396 | 02/06/08 | 08/06/09 |

# 7. ANTENNA PORT TEST RESULTS

## 7.1. 5.2 GHz BAND CHANNEL TESTS FOR 802.11a MODE

### 7.1.1. 26 dB and 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

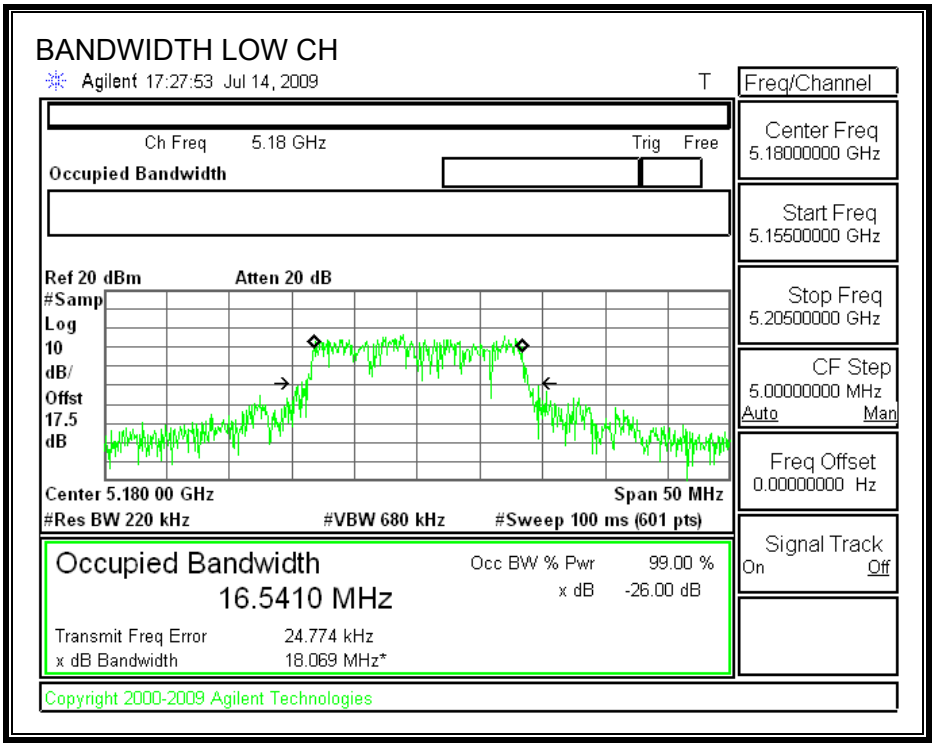
**TEST PROCEDURE**

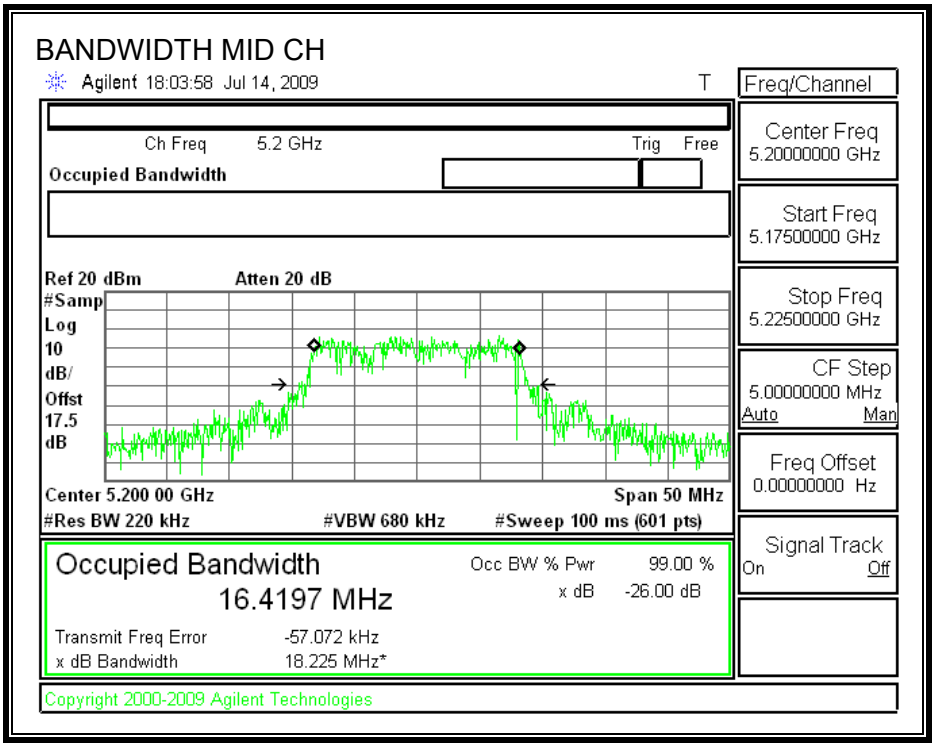
The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

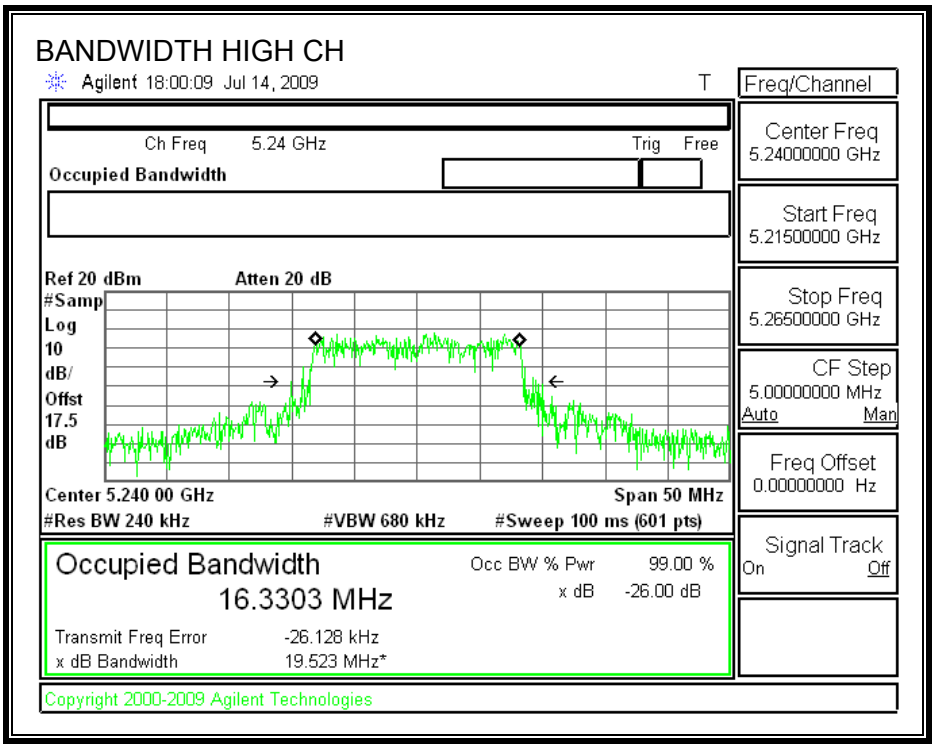
**RESULTS**

| Channel | Frequency (MHz) | 26 dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|---|---|---|---|
| Low | 5180 | 18.0690 | 16.5410 |
| Middle | 5200 | 18.2250 | 16.4197 |
| High | 5240 | 19.5230 | 16.3303 |

**26 dB and 99% BANDWIDTH**





## 7.1.2. OUTPUT POWER

**LIMITS**

FCC §15.407 (a) (1)
IC RSS-210 A9.2 (1)

Antenna gain of Chain 1 = antenna gain of Chain 2.

| Antenna Gain (dBi) | 10 Log (# Tx Chains) (dB) | Effective Legacy Gain (dBi) |
|---|---|---|
| 3 | 3.01 | 6.01 |

For the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**TEST PROCEDURE**

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.
The transmitter output operates continuously therefore Method # 1 is used.

**RESULTS**

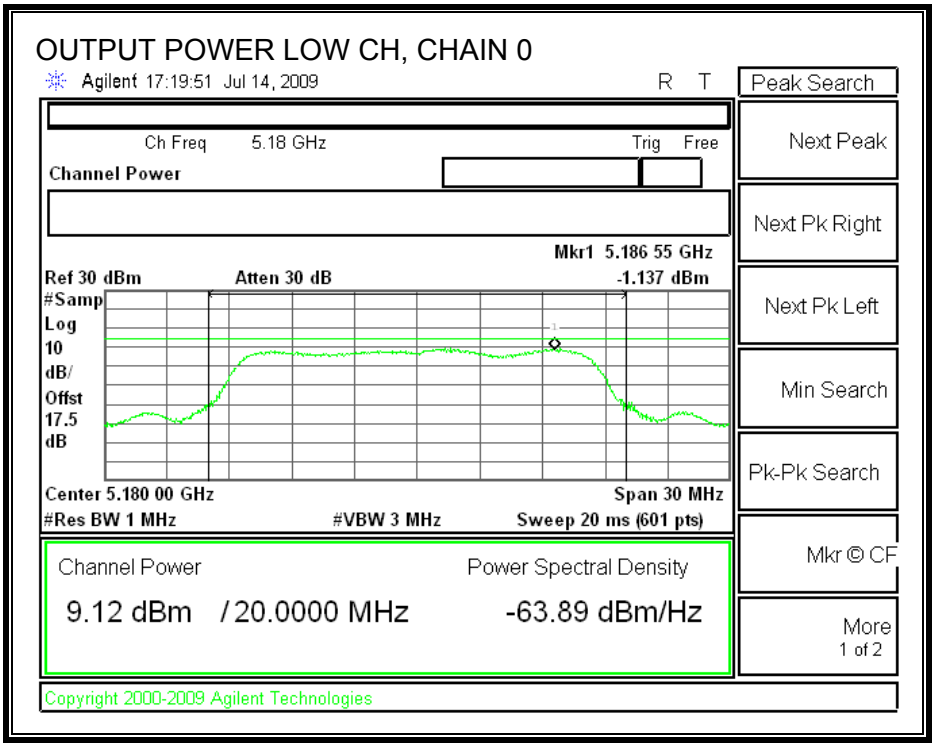
**Limit**

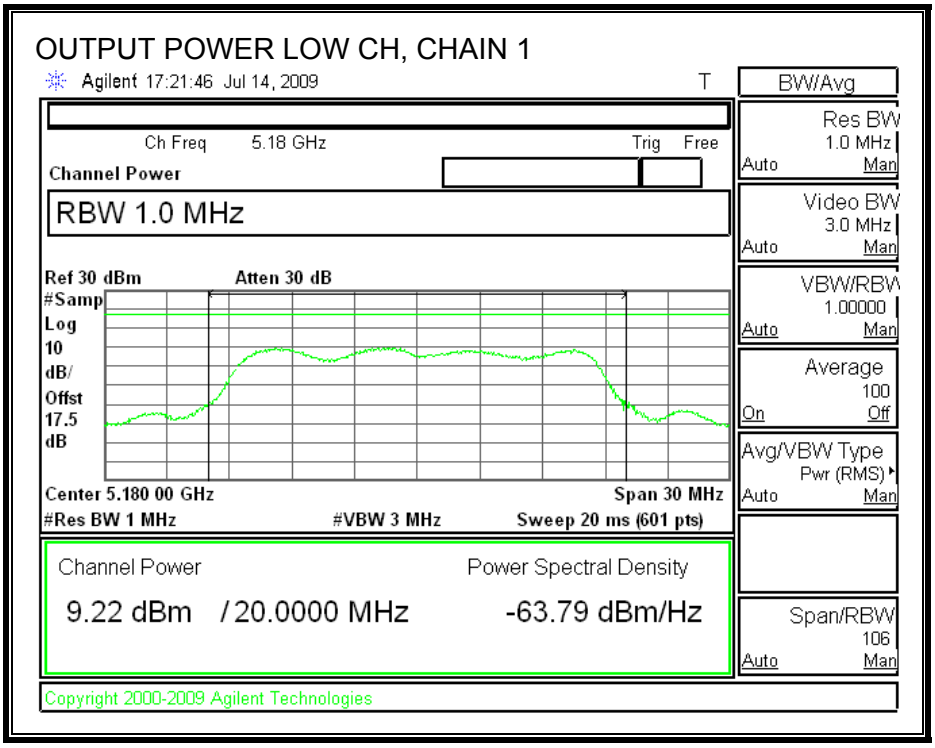
| Channel | Freq (MHz) | Fixed Limit (dBm) | B (MHz) | 4 + 10 Log B Limit (dBm) | Effective AntennaGain (dBi) | Limit (dBm) |
|---|---|---|---|---|---|---|
| Low | 5180 | 17 | 18.069 | 16.57 | 6.01 | 16.56 |
| Mid | 5200 | 17 | 18.225 | 16.61 | 6.01 | 16.60 |
| High | 5240 | 17 | 19.523 | 16.91 | 6.01 | 16.90 |

**Individual Chain Results**

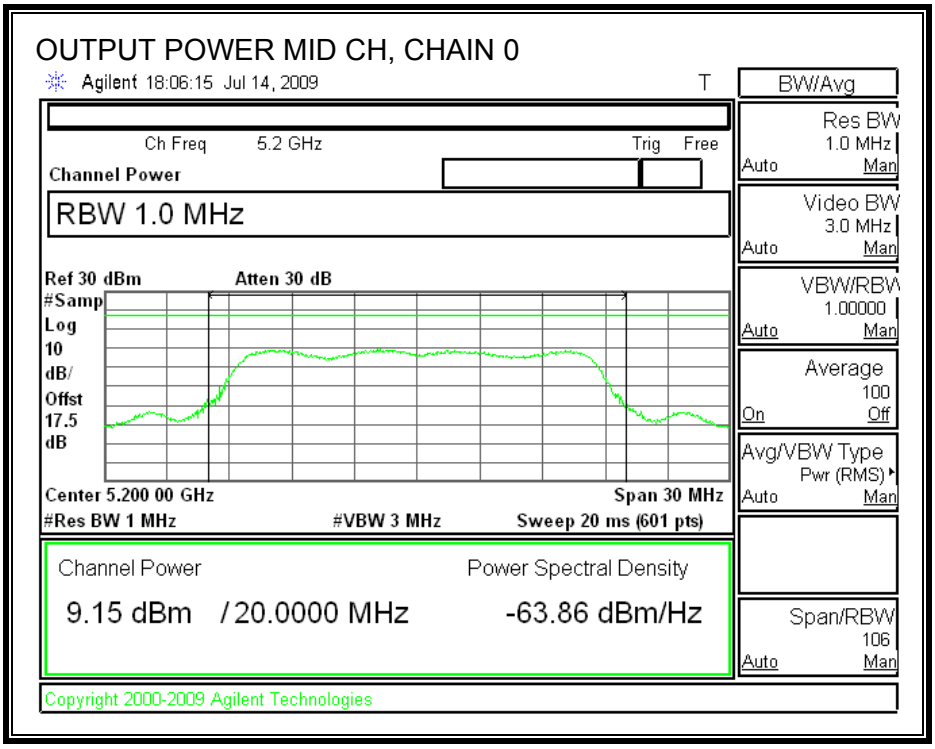
| Channel | Freq (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|
| Low | 5180 | 9.12 | 9.22 | 12.18 | 16.56 | -4.38 |
| Mid | 5200 | 9.15 | 8.96 | 12.07 | 16.60 | -4.53 |
| High | 5240 | 9.18 | 9.13 | 12.17 | 16.90 | -4.73 |

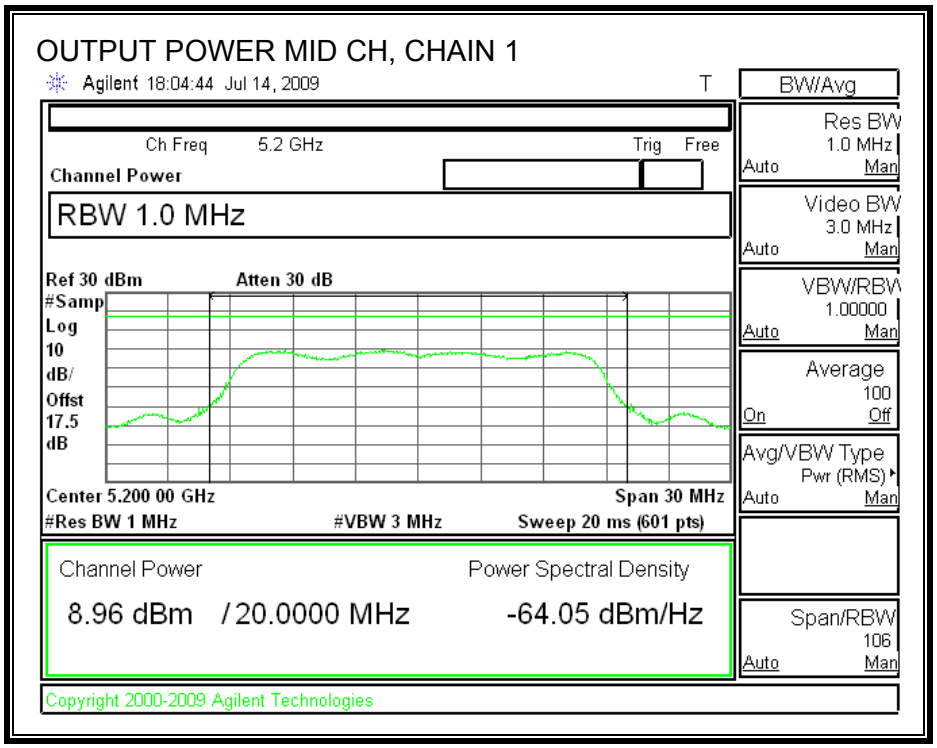
**OUTPUT POWER, LOW CHANNEL**



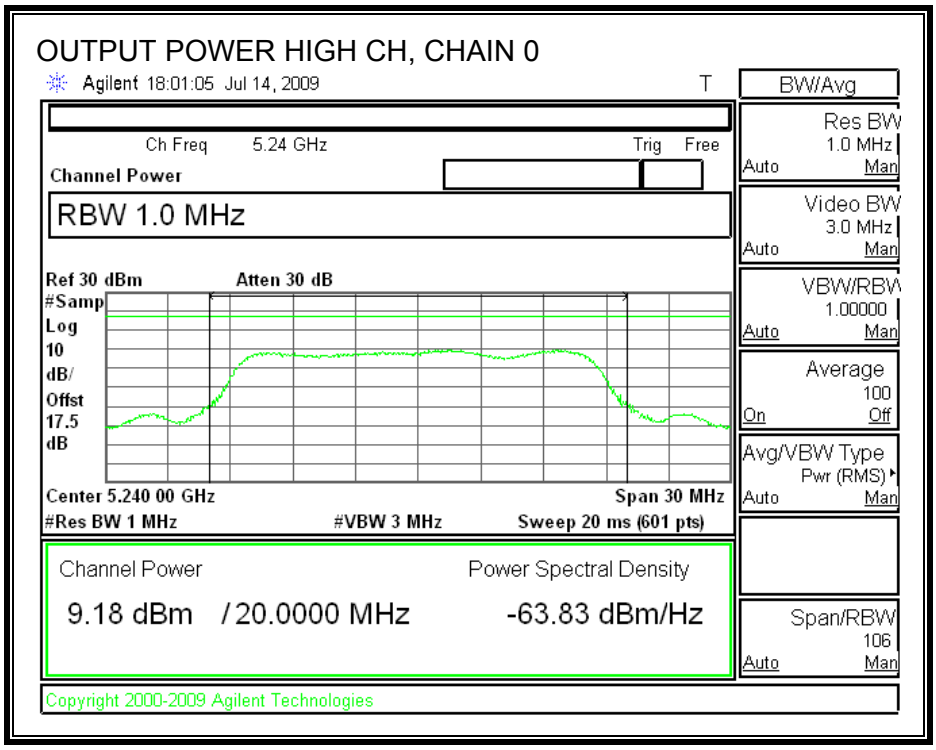



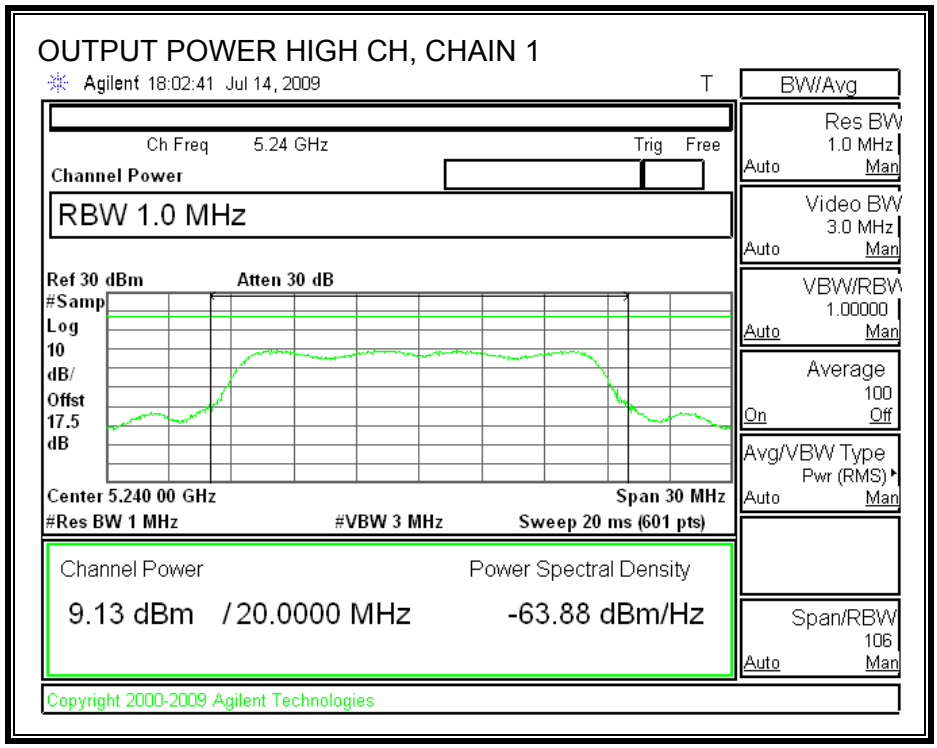
**OUTPUT POWER, MID CHANNEL**



**OUTPUT POWER, HIGH CHANNEL**



## 7.1.3. AVERAGE POWER

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a power meter.

**RESULTS**

The cable assembly insertion loss of 11.3 dB (including 10 dB pad and 1.3 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

| Channel | Frequency (MHz) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Total Power (dBm) |
|---|---|---|---|---|
| Low | 5180 | 9.12 | 9.08 | 12.11 |
| Middle | 5200 | 9.21 | 9.05 | 12.14 |
| High | 5240 | 9.16 | 8.99 | 12.09 |

## 7.1.4. PEAK POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

Use this table if antenna gain for Chain 1 = antenna gain for Chain 2

| Antenna Gain (dBi) | 10 Log (# Tx Chains) (dB) | Effective Legacy Gain (dBi) |
|---|---|---|
| 3 | 3.01 | 6.01 |

For the 5.15-5.25 GHz band, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum effective antenna gain is 6.01 dBi, therefore the limit is 3.99 dBm.

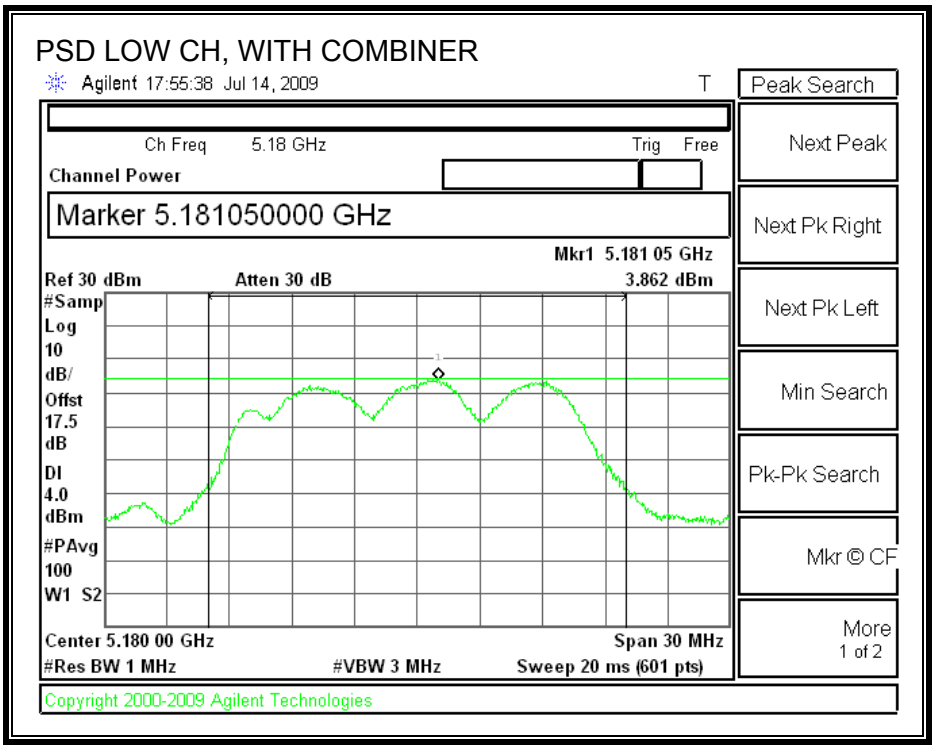
**TEST PROCEDURE**

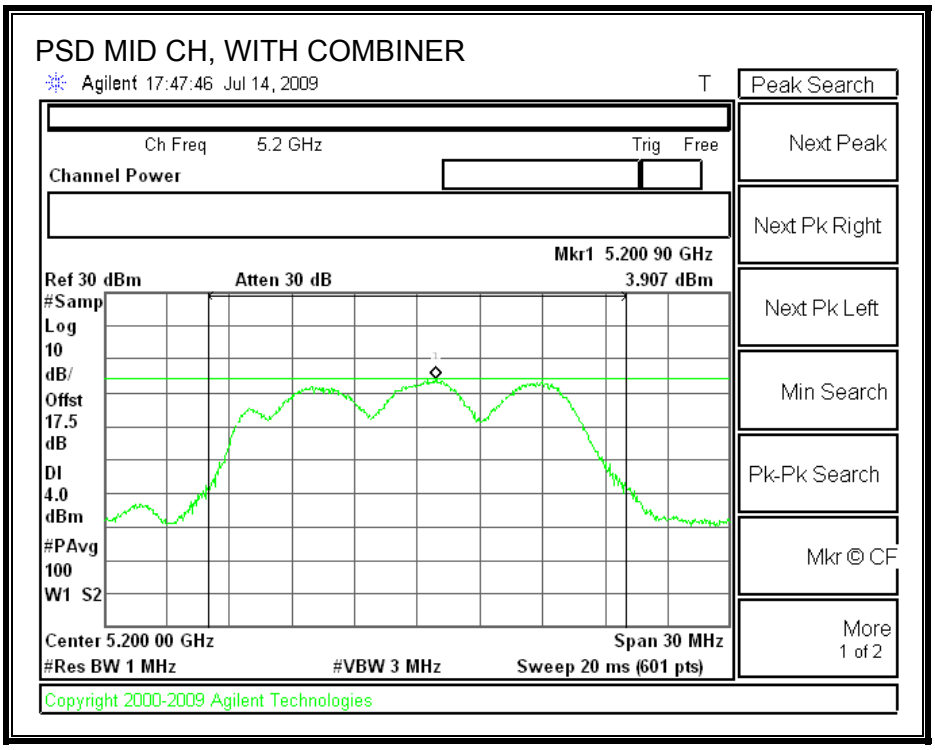
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

**RESULTS**

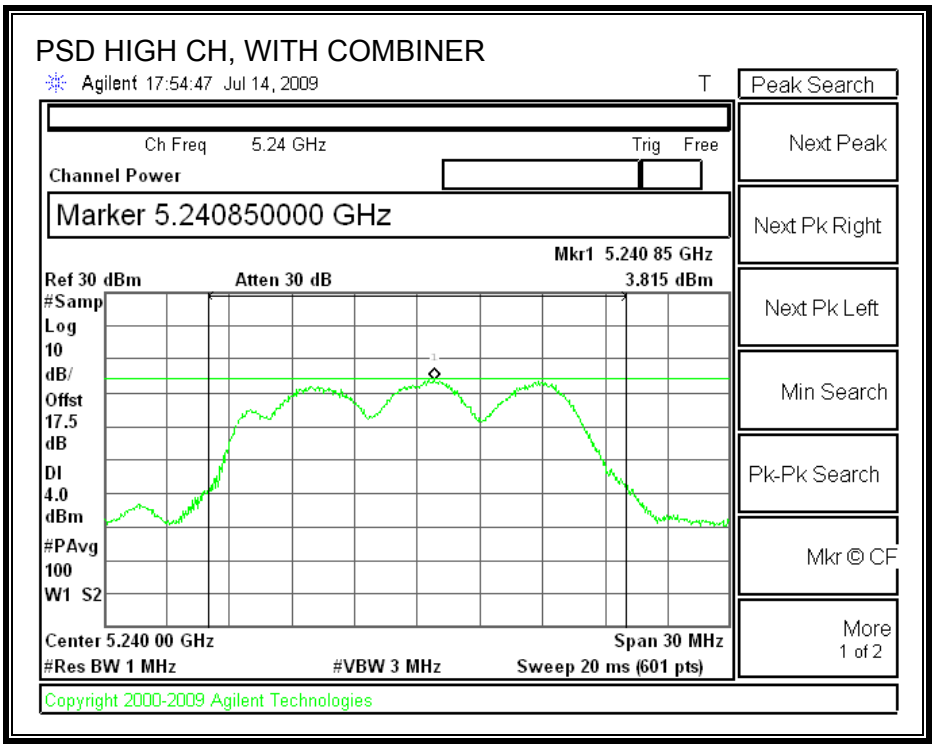
| Channel | Frequency (MHz) | PPSD With Combiner (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| **Low** | **5180** | **3.86** | **3.99** | **-0.13** |
| **Middle** | **5200** | **3.91** | **3.99** | **-0.08** |
| **High** | **5240** | **3.82** | **3.99** | **-0.18** |

**POWER SPECTRAL DENSITY WITH COMBINER**



PSD HIGH CH, WITH COMBINER



## 7.1.5. PEAK EXCURSION

**LIMITS**

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

**TEST PROCEDURE**

The transmitter outputs are connected to the spectrum analyzer via a combiner.

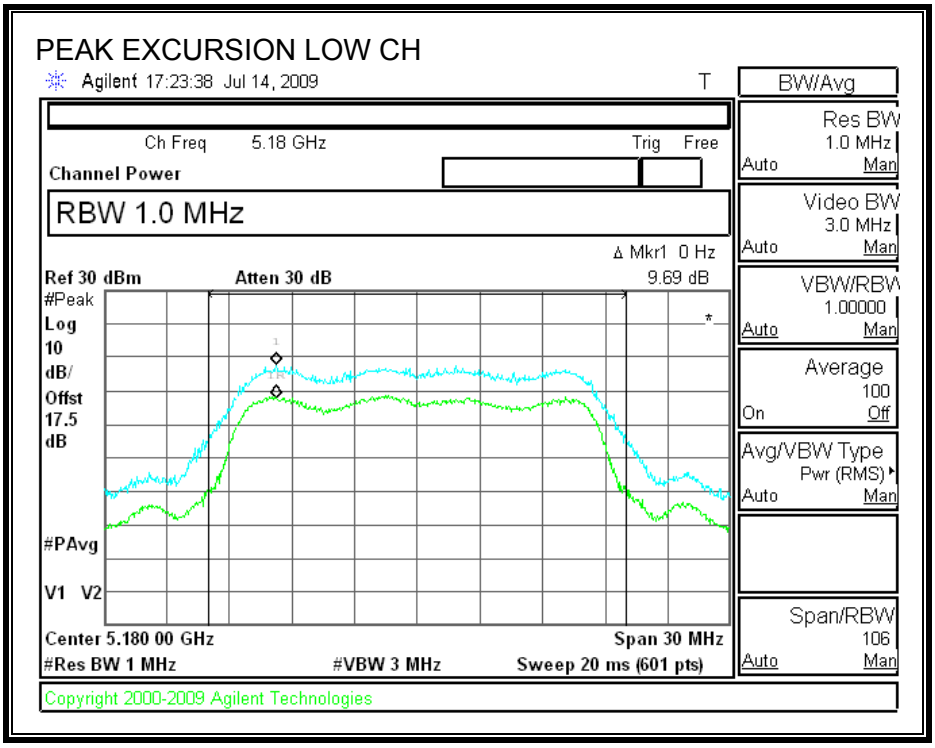
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

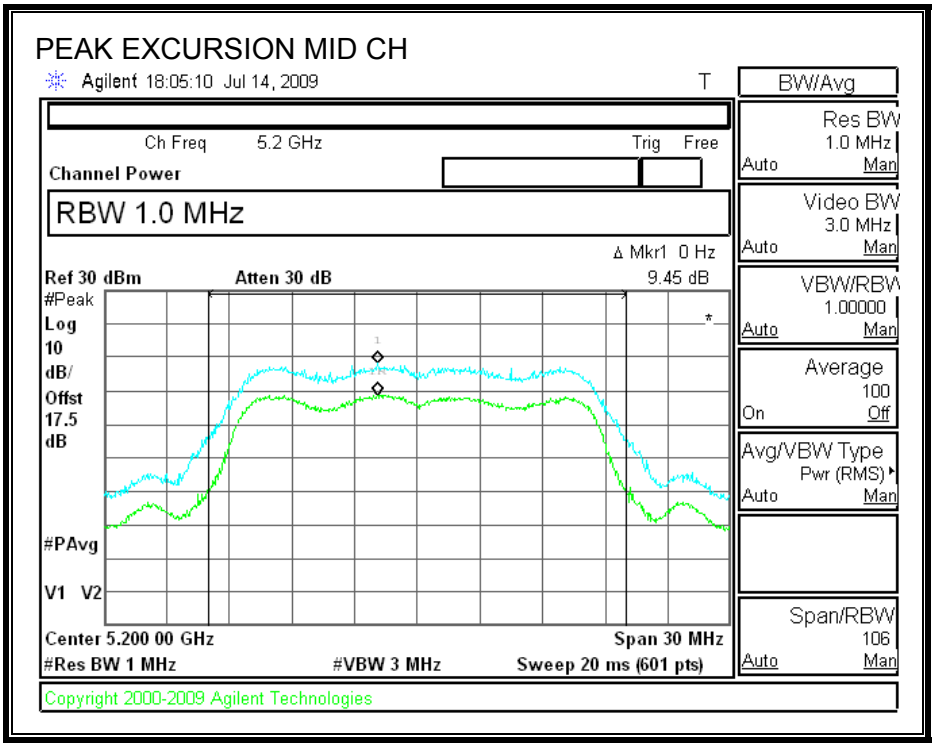
Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

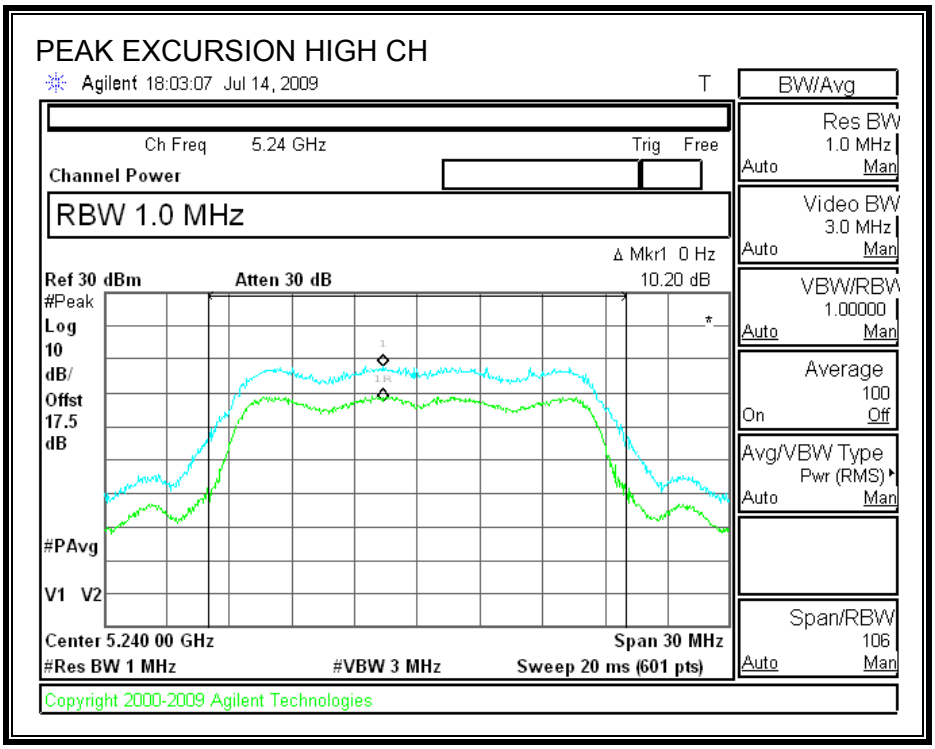
**RESULTS**

| Channel | Frequency (MHz) | Peak Excursion (dB) | Limit (dB) | Margin (dB) |
|---|---|---|---|---|
| Low | 5180 | 9.69 | 13 | -3.31 |
| Middle | 5200 | 9.45 | 13 | -3.55 |
| High | 5240 | 10.20 | 13 | -2.80 |

**PEAK EXCURSION**





## 7.1.6. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.407 (b) (1)

IC RSS-210 A9.3 (1)

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

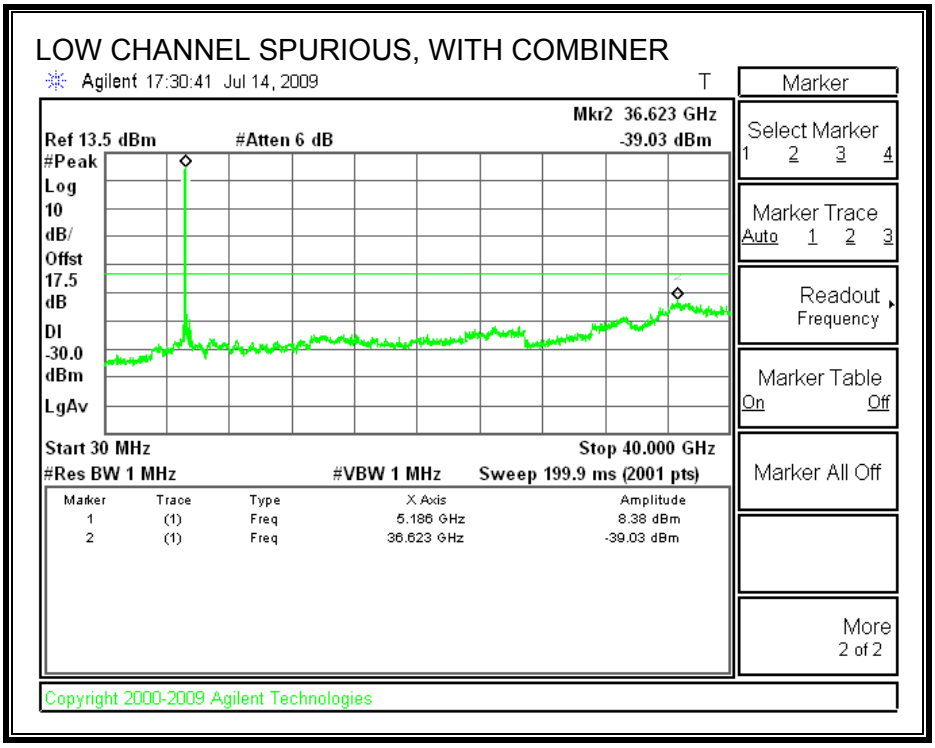
**TEST PROCEDURE**

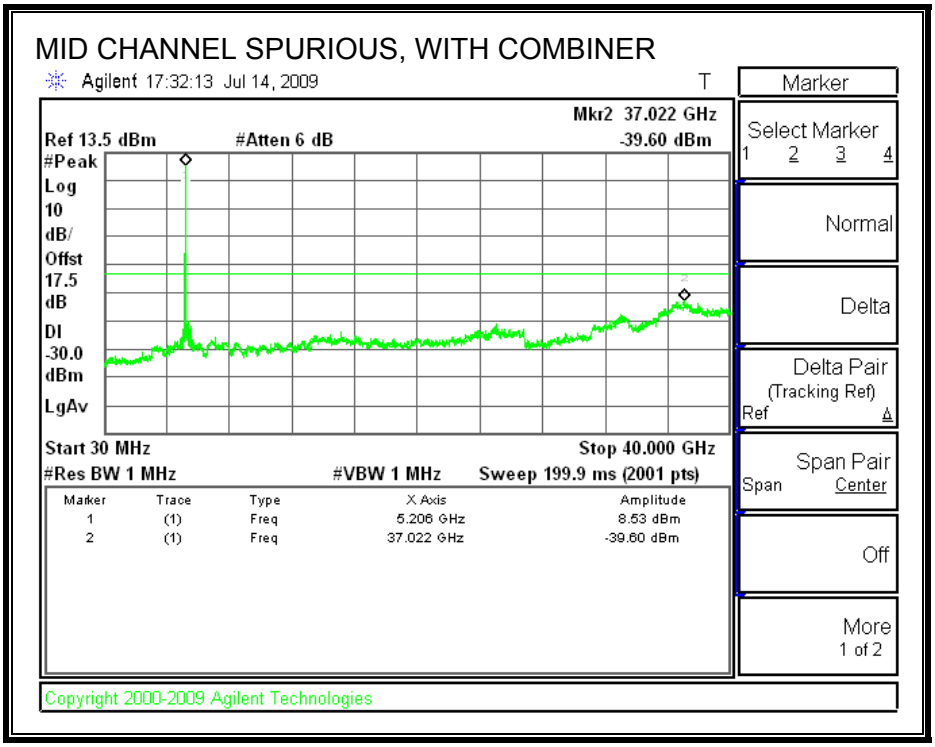
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

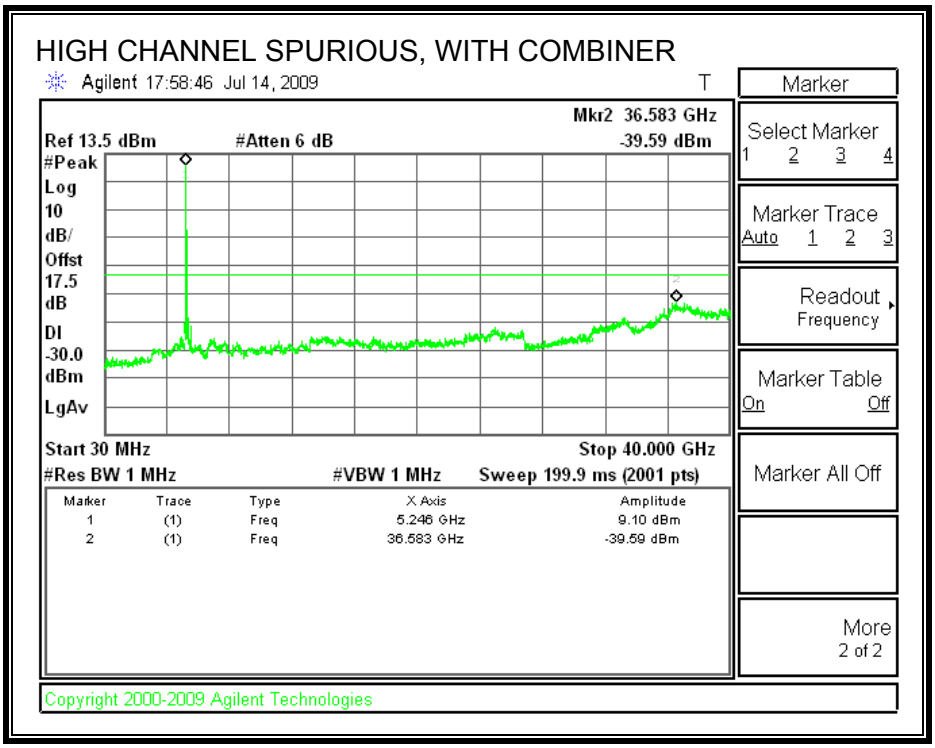
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

**SPURIOUS EMISSIONS WITH COMBINER**



HIGH CHANNEL SPURIOUS, WITH COMBINER



## 7.2. 5.2 GHz BAND CHANNEL TESTS FOR 802.11n HT20 MODE

### 7.2.1. 99% & 26 dB BANDWIDTH

**LIMITS**

None; for reporting purposes only.

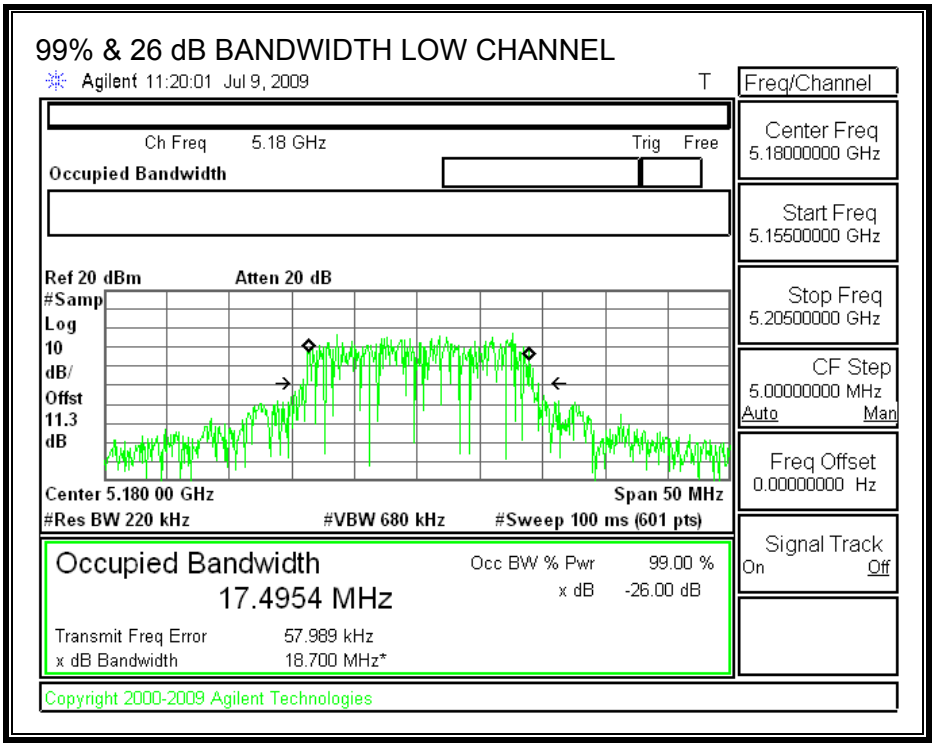
**TEST PROCEDURE**

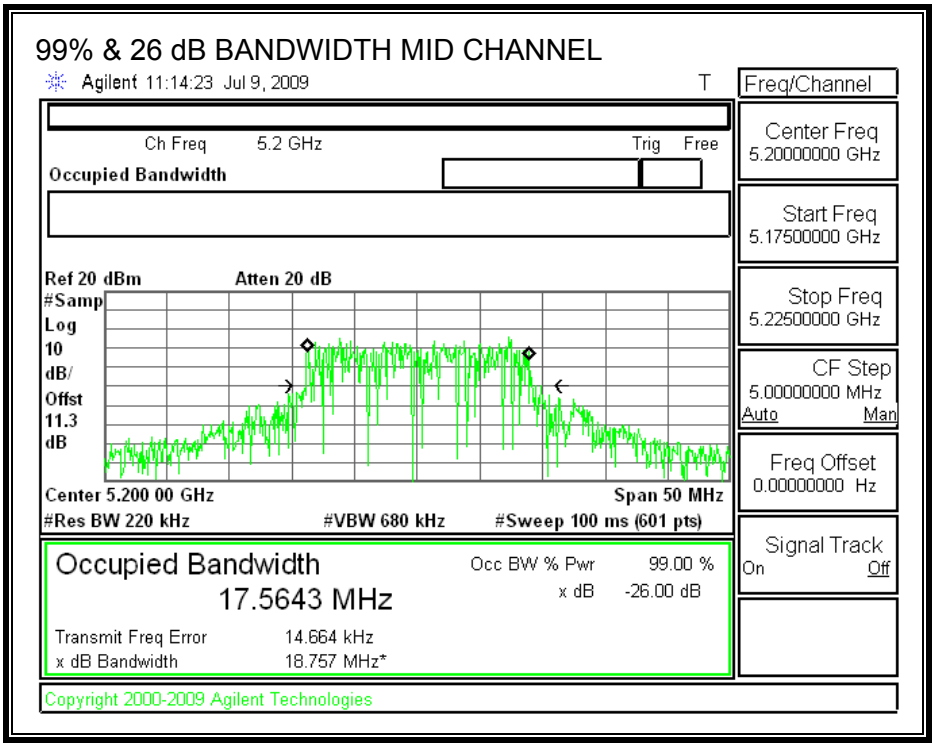
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth measurement function is utilized.

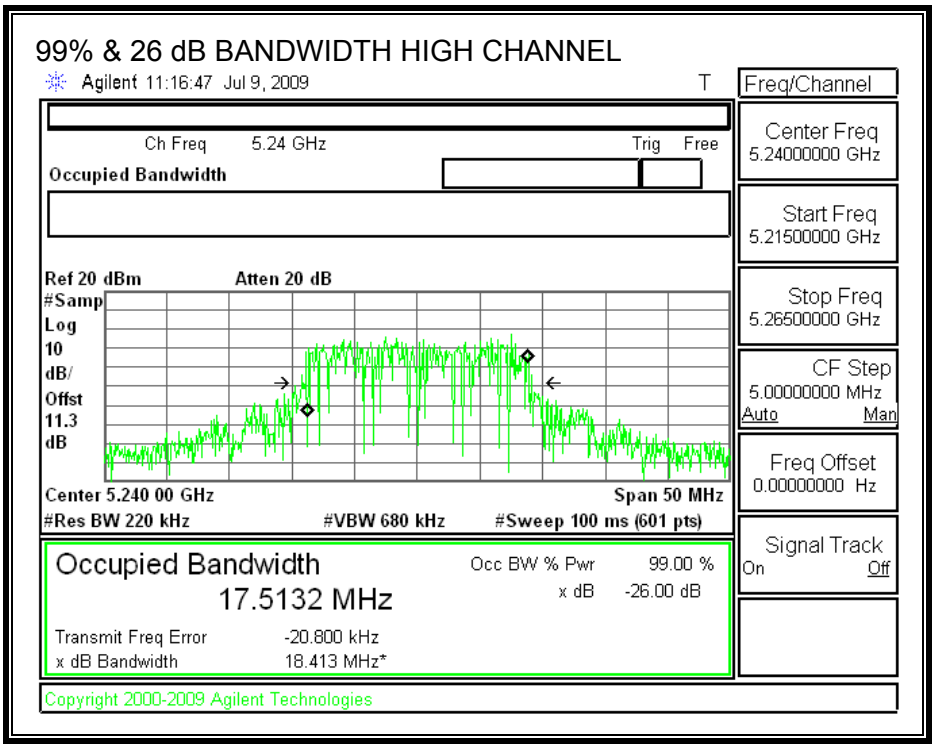
**RESULTS**

| Channel | Frequency (MHz) | 99% OBW (MHz) | 26 dB BW (MHz) |
|---|---|---|---|
| Low | 5180 | 17.4954 | 18.700 |
| Middle | 5200 | 17.5643 | 18.757 |
| High | 5240 | 17.5132 | 18.413 |

**99% & 26 dB BANDWIDTH**





## 7.2.2. OUTPUT POWER

**LIMITS**

FCC §15.407 (a) (2)
IC RSS-210 A9.2 (2)
For the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**TEST PROCEDURE**

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

**RESULTS**

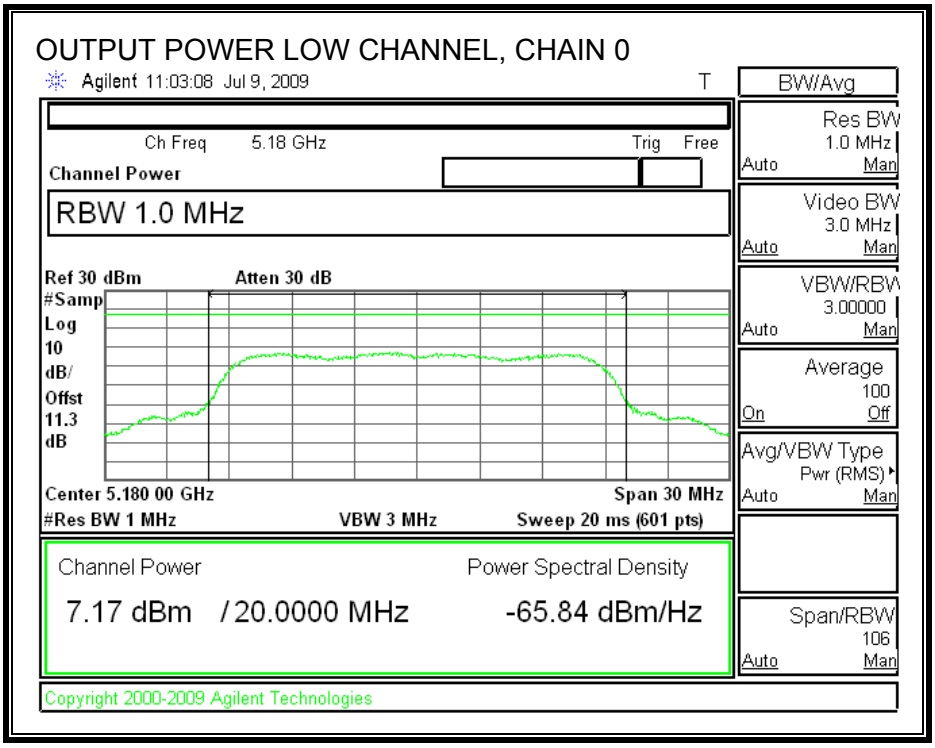
**Limit**

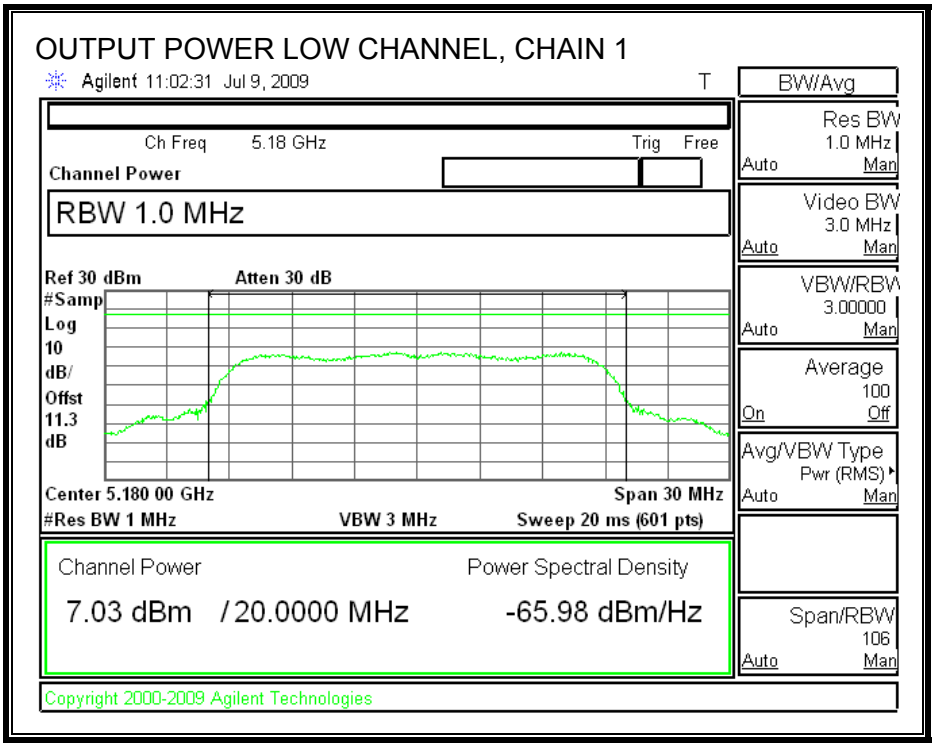
| Channel | Freq (MHz) | Fixed Limit (dBm) | B (MHz) | 4 + 10 Log B Limit (dBm) | Antenna Gain (dBi) | Limit (dBm) |
|---|---|---|---|---|---|---|
| Low | 5180 | 17 | 18.700 | 16.72 | 3 | 16.72 |
| Mid | 5200 | 17 | 18.757 | 16.73 | 3 | 16.73 |
| High | 5240 | 17 | 18.413 | 16.65 | 3 | 16.65 |

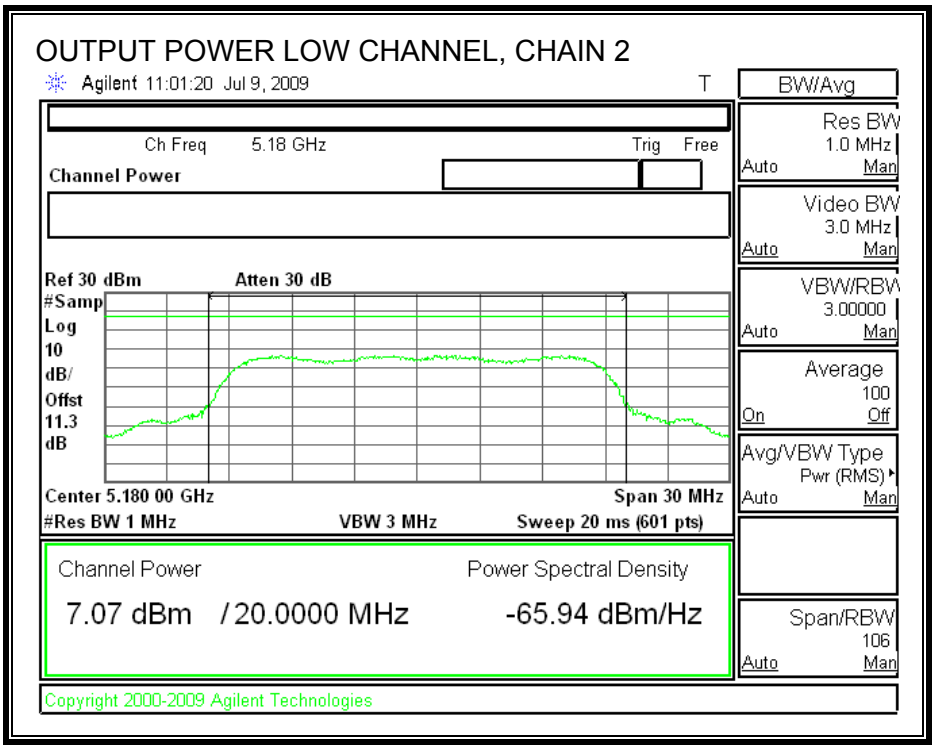
**Individual Chain Results**

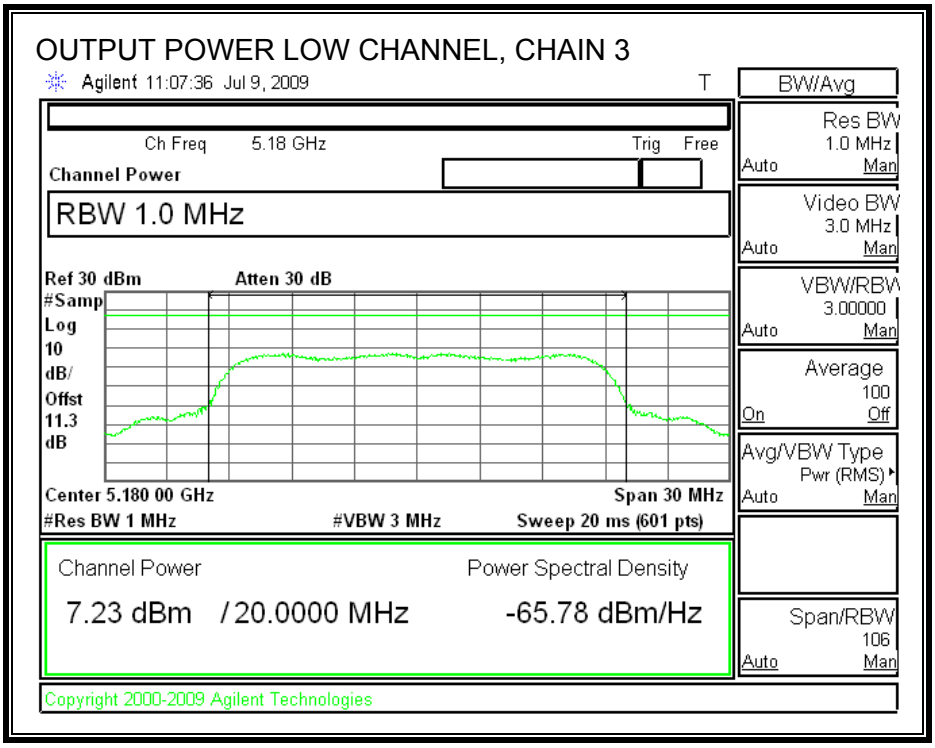
| Channel | Freq (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Chain 3 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| Low | 5180 | 7.17 | 7.03 | 7.07 | 7.23 | 13.15 | 16.72 | -3.57 |
| Mid | 5200 | 7.16 | 7.17 | 7.22 | 7.28 | 13.23 | 16.73 | -3.50 |
| High | 5240 | 7.16 | 7.14 | 7.18 | 7.28 | 13.21 | 16.65 | -3.44 |

**OUTPUT POWER, LOW CHANNEL**

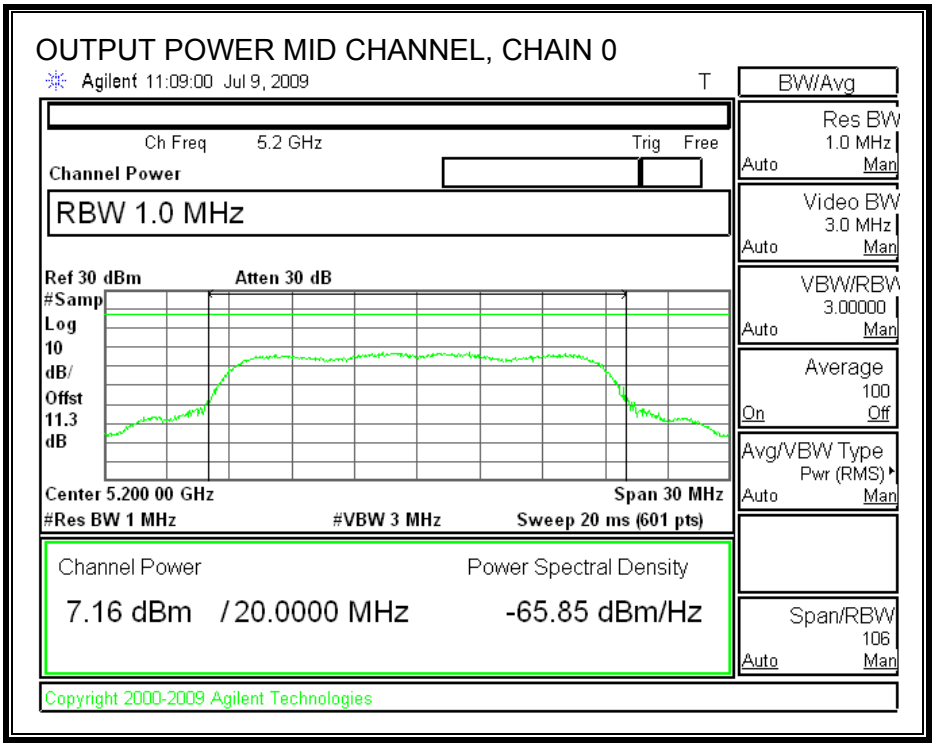


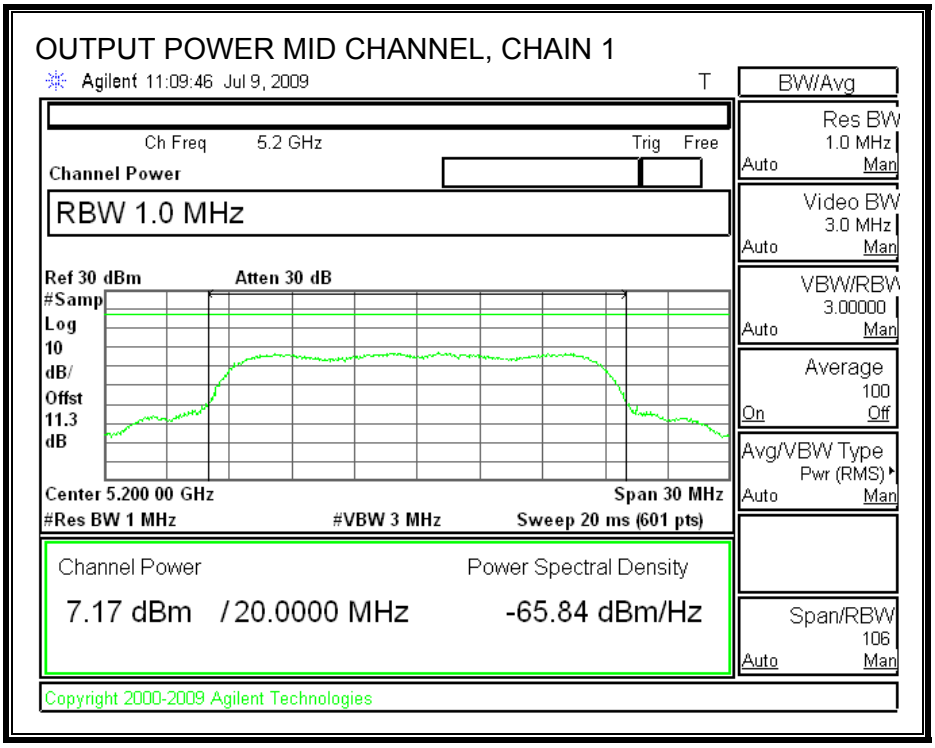





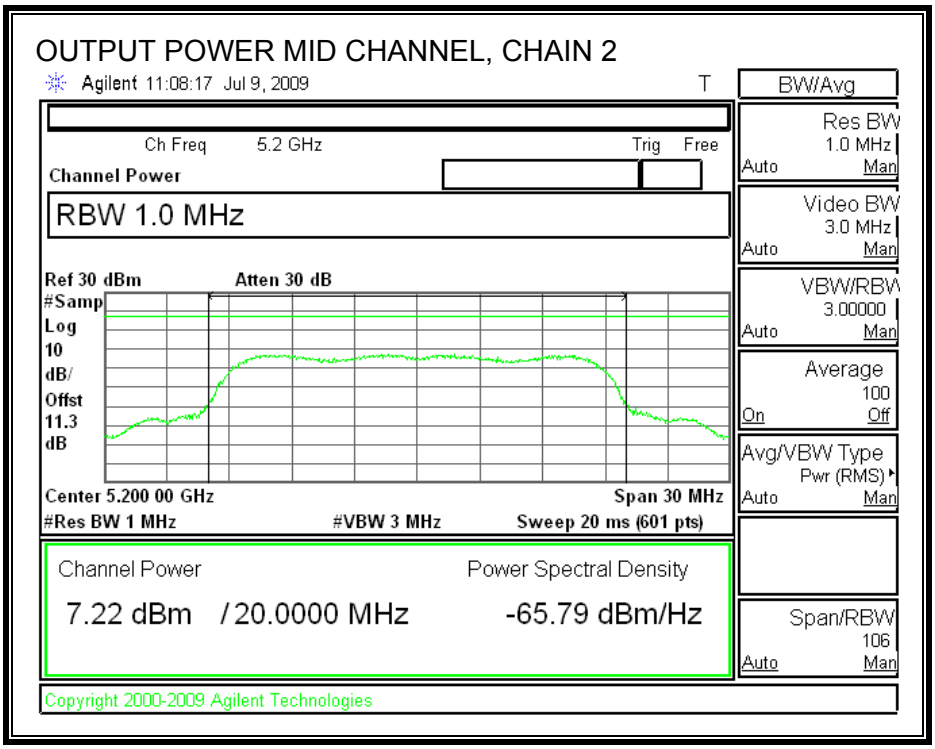



**OUTPUT POWER, MID CHANNEL**

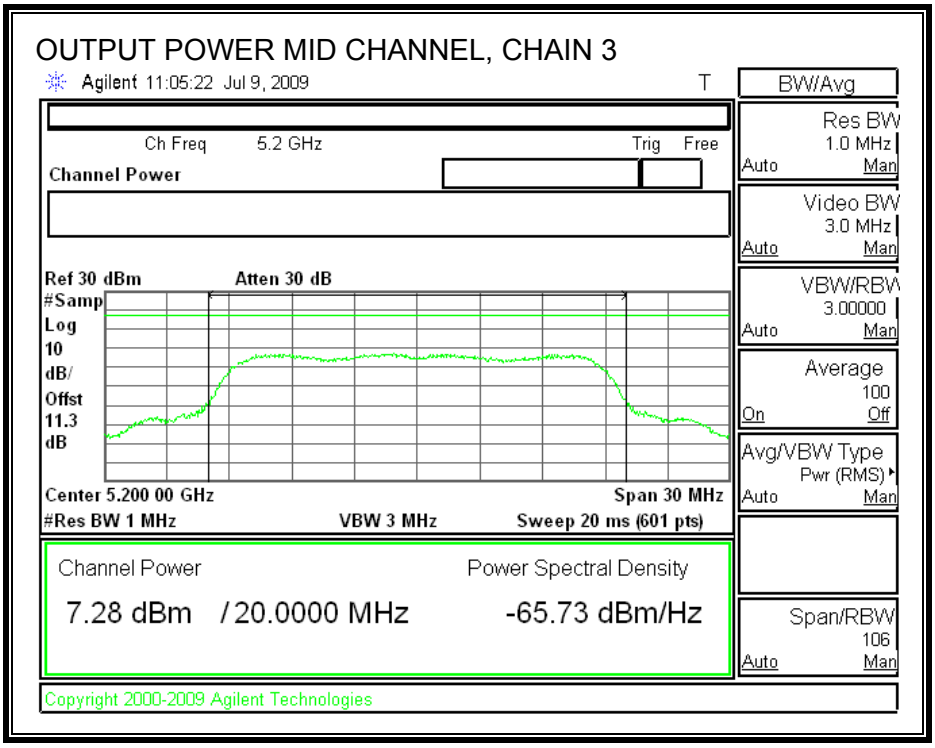


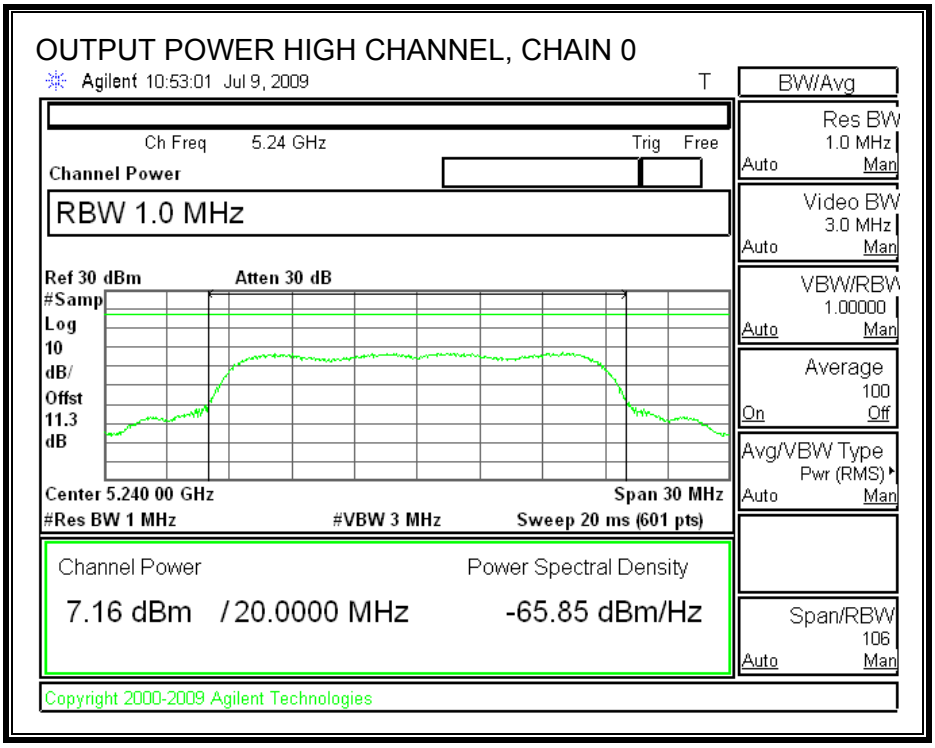
OUTPUT POWER MID CHANNEL, CHAIN 2

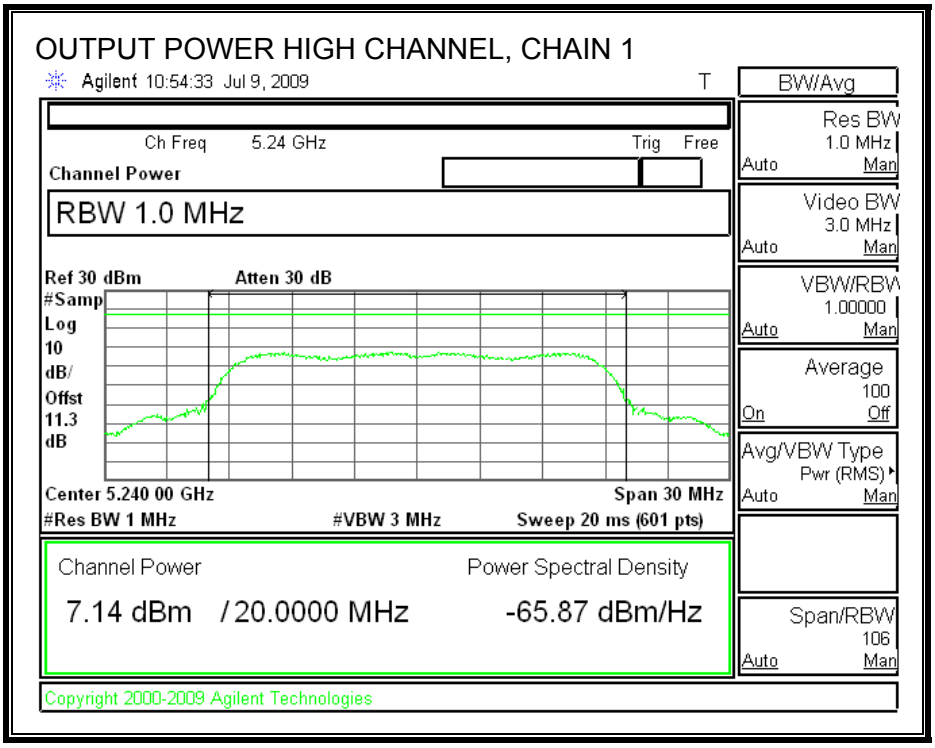



OUTPUT POWER MID CHANNEL, CHAIN 3

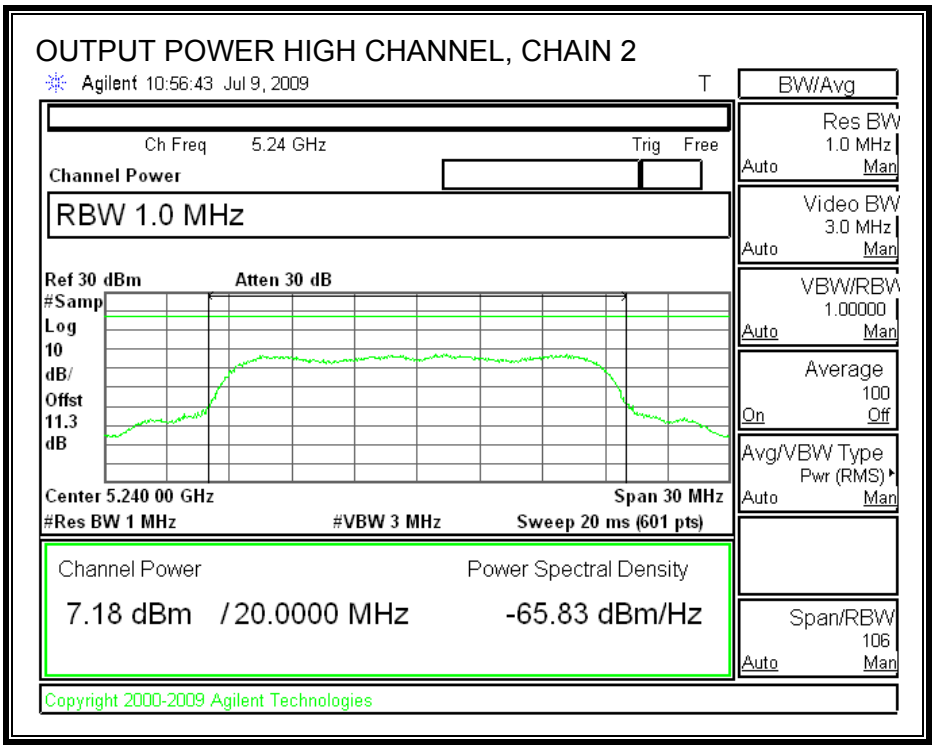


**OUTPUT POWER, HIGH CHANNEL**

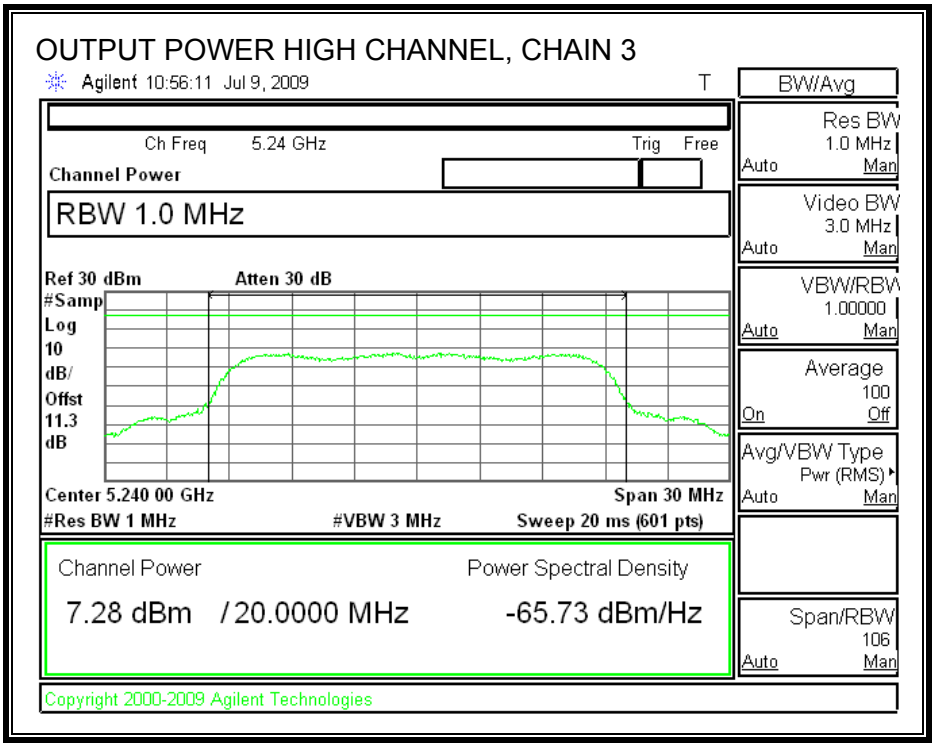


OUTPUT POWER HIGH CHANNEL, CHAIN 2




OUTPUT POWER HIGH CHANNEL, CHAIN 3



## 7.2.3. AVERAGE POWER

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.3 dB (including 10 dB pad and 1.3 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

**RESULTS**

| Frequency (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Chain 3 Power (dBm) |
|---|---|---|---|---|
| 5180 | 7.14 | 7.26 | 7.10 | 7.23 |
| 5200 | 7.15 | 7.21 | 7.24 | 7.23 |
| 5240 | 7.35 | 7.32 | 7.39 | 7.28 |

## 7.2.4. PEAK POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.15-5.25 GHz band, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is less than 6 dBi; therefore the limit is 4 dBm.

**TEST PROCEDURE**

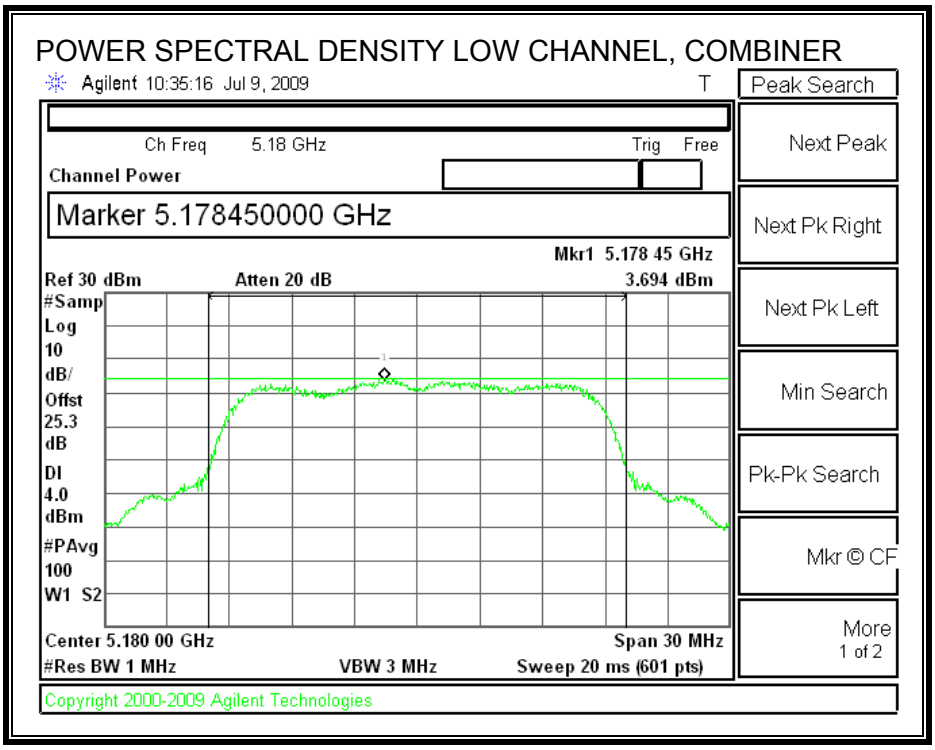
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

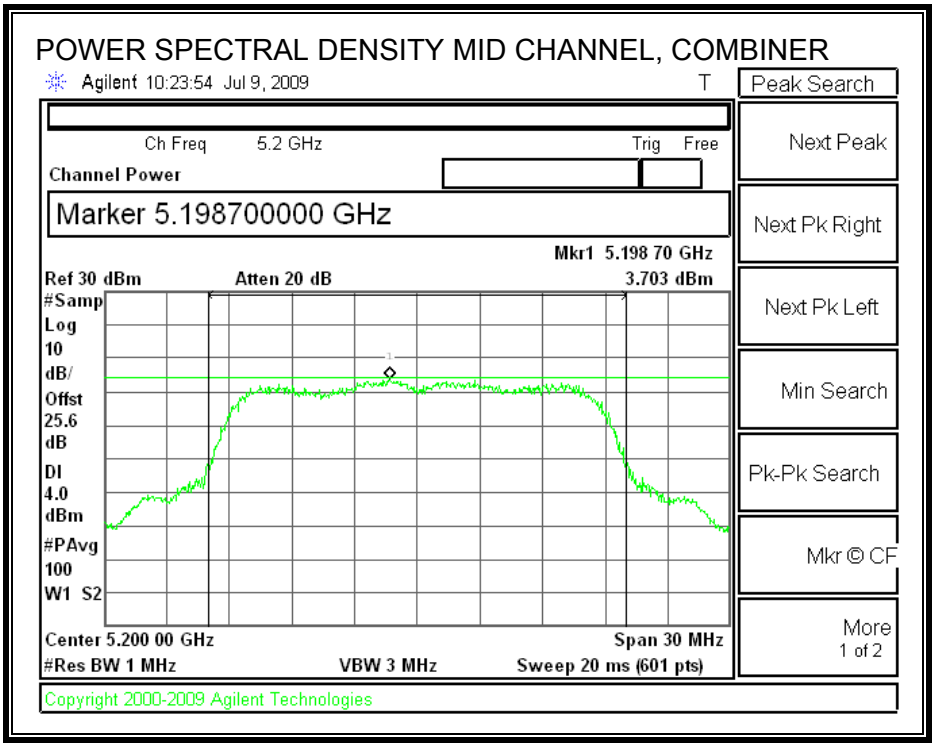
Preliminary tests on individual chains, and on all chains with a combiner, were performed. The worst-case configuration was with a combiner, therefore final test were performed with all chains feeding a combiner.

**RESULTS**

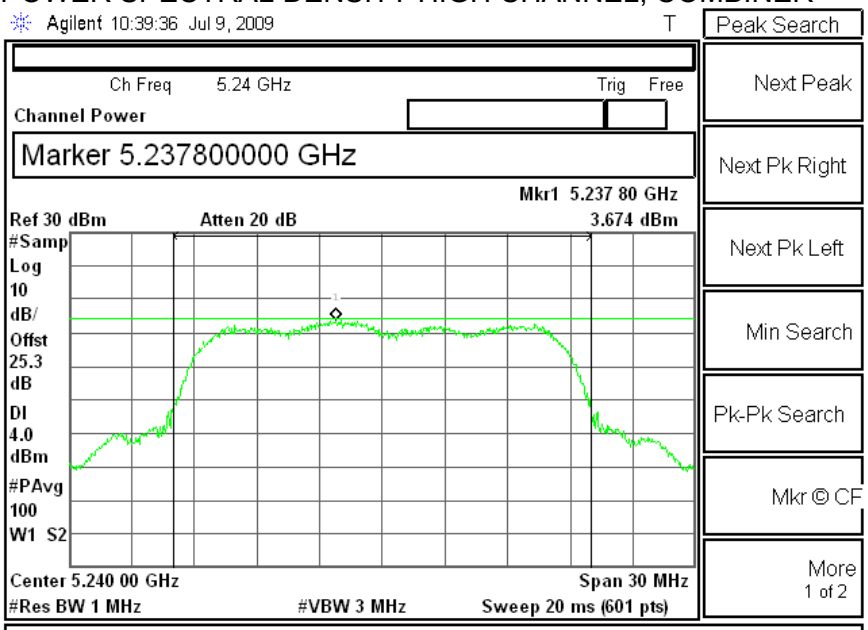
| Channel | Frequency (MHz) | PSD with Combiner (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 5180 | 3.69 | 4 | -0.31 |
| Middle | 5200 | 3.70 | 4 | -0.30 |
| High | 5240 | 3.67 | 4 | -0.33 |

**POWER SPECTRAL DENSITY**



POWER SPECTRAL DENSITY HIGH CHANNEL, COMBINER



## 7.2.5. PEAK EXCURSION

**LIMITS**

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

**TEST PROCEDURE**

The transmitter outputs are connected to the spectrum analyzer via a combiner.

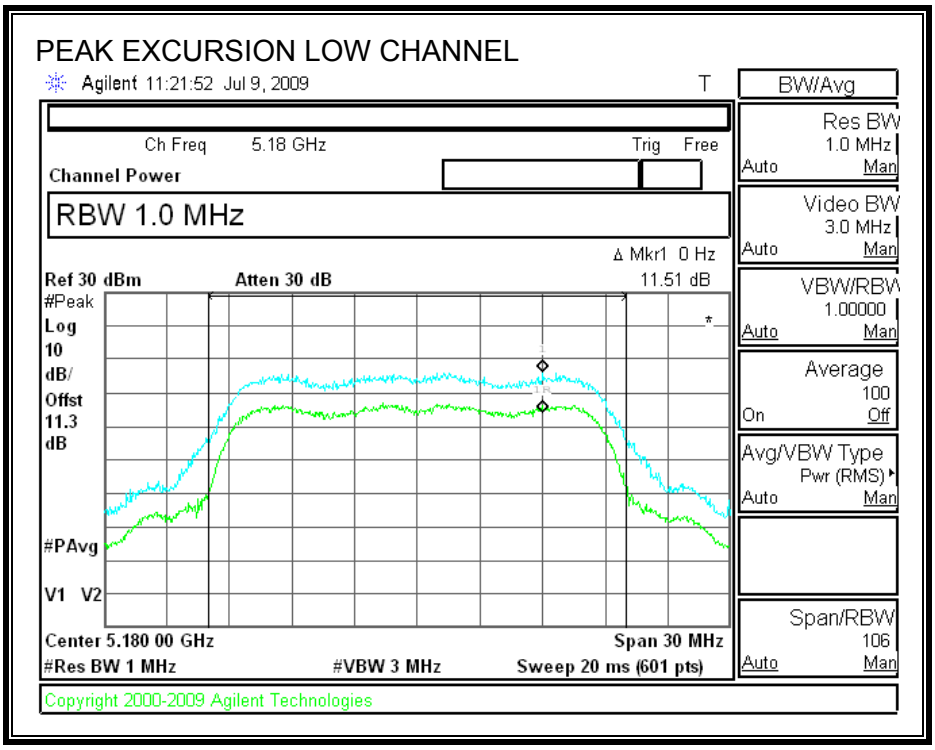
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

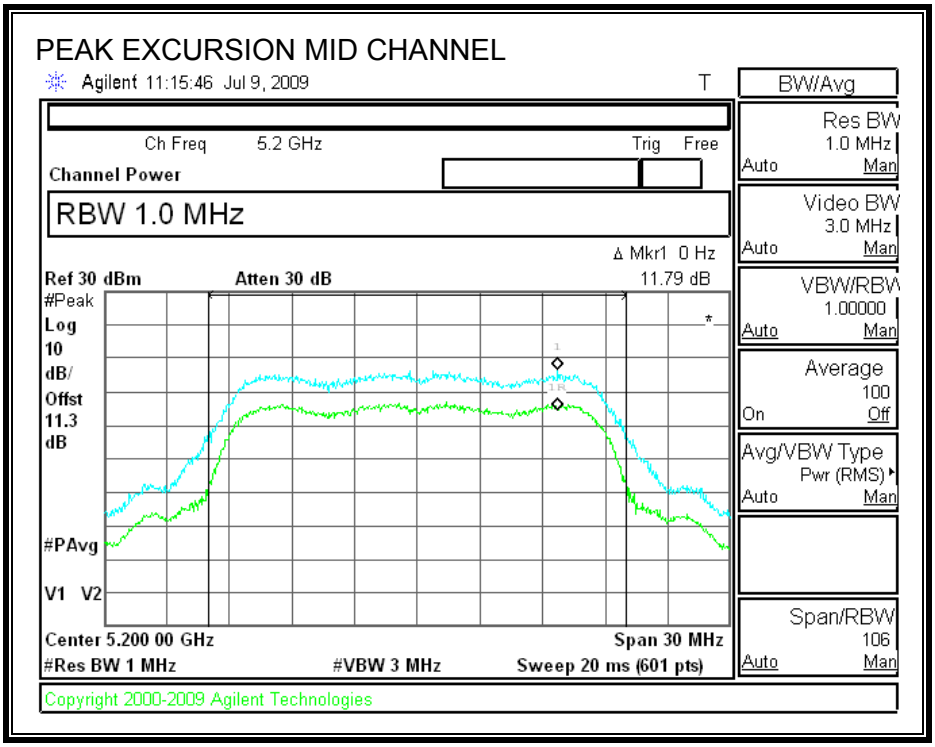
Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

**RESULTS**

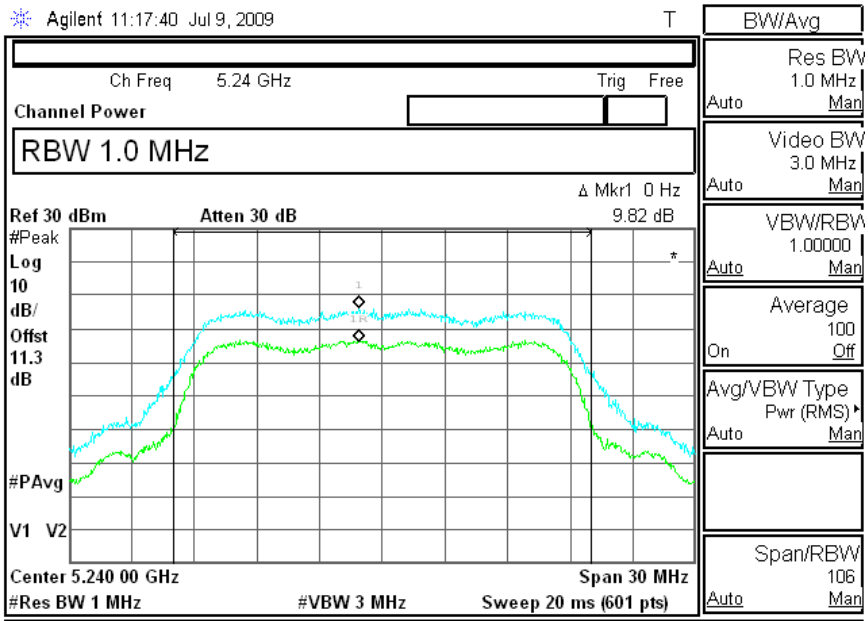
| Channel | Frequency (MHz) | Peak Excursion (dB) | Limit (dB) | Margin (dB) |
|---|---|---|---|---|
| Low | 5180 | 11.51 | 13 | -1.49 |
| Middle | 5200 | 11.79 | 13 | -1.21 |
| High | 5240 | 9.82 | 13 | -3.18 |

**PEAK EXCURSION**



PEAK EXCURSION HIGH CHANNEL



## 7.2.6. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.407 (b) (3)

IC RSS-210 A9.3 (3)

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

**TEST PROCEDURE**

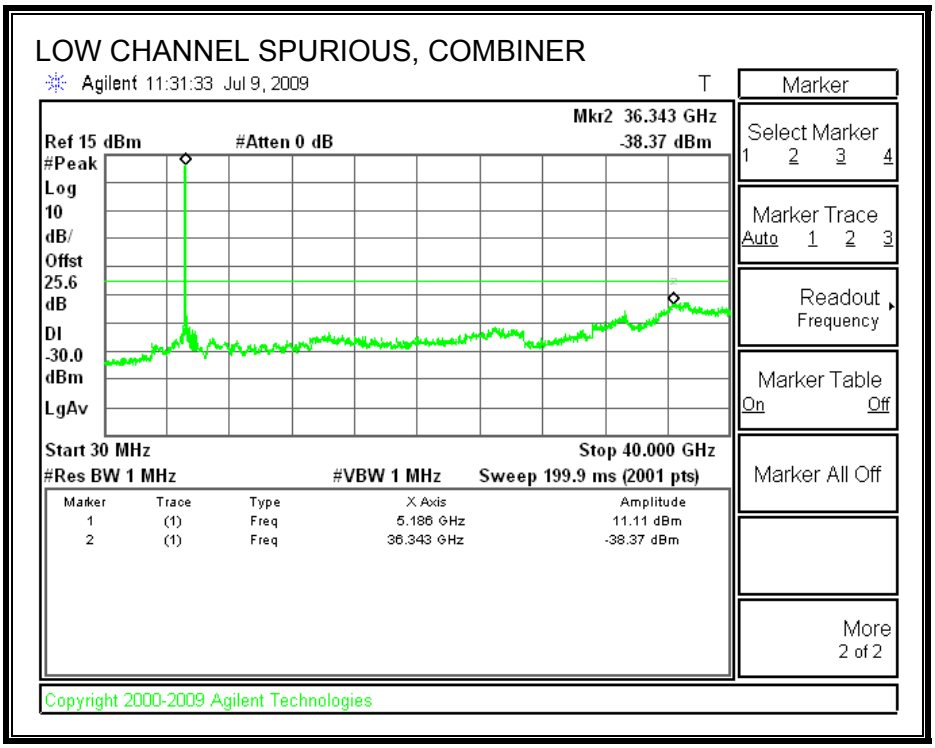
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

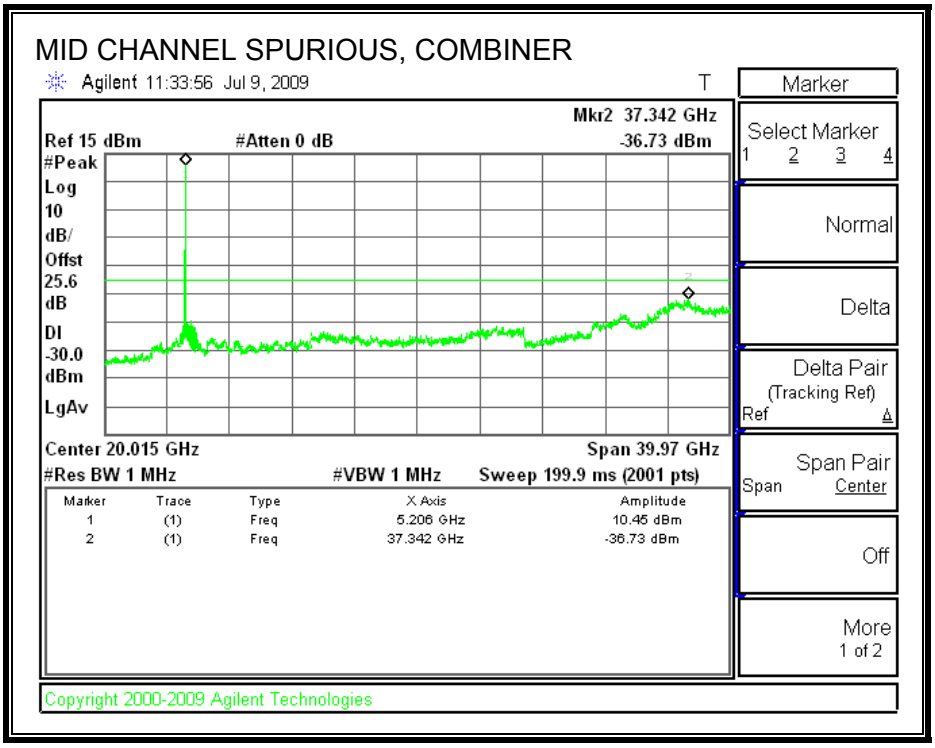
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

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

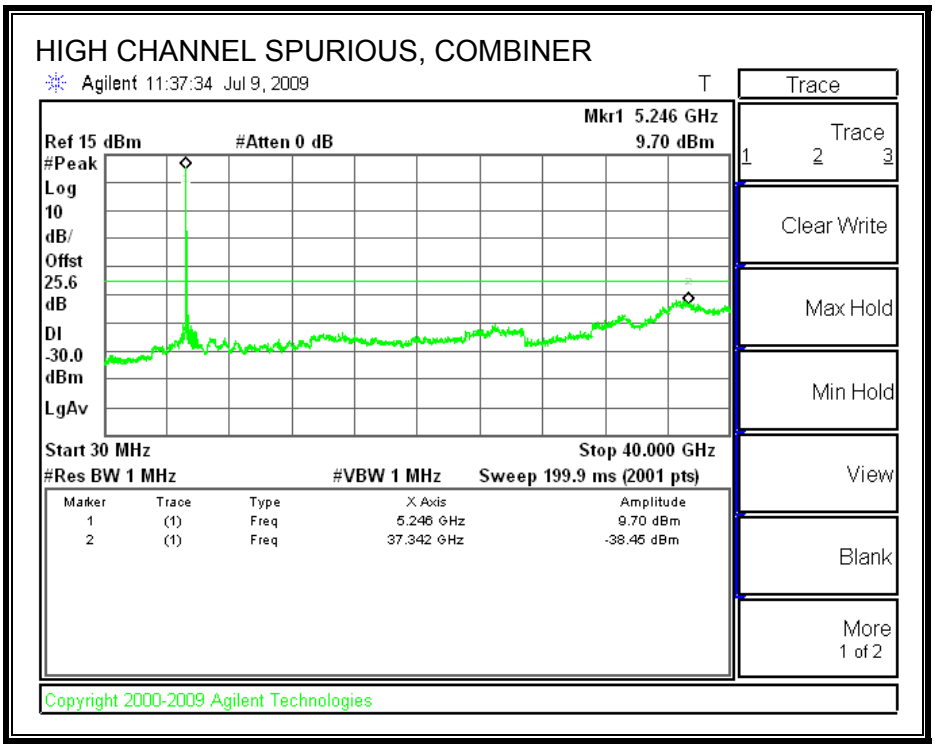
**LOW CHANNEL SPURIOUS EMISSIONS**




**MID CHANNEL SPURIOUS EMISSIONS**



**HIGH CHANNEL SPURIOUS EMISSIONS**



## 7.3. 5.2 GHz BAND CHANNEL TESTS FOR 802.11n HT40 MODE

### 7.3.1. 99% & 26 dB BANDWIDTH

**LIMITS**

None; for reporting purposes only.

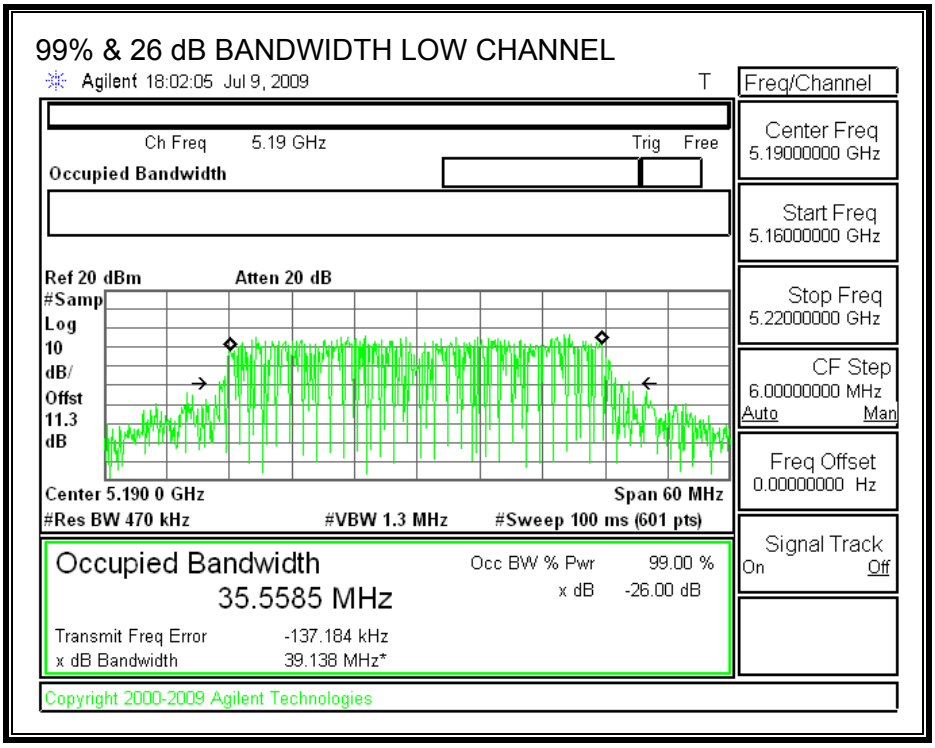
**TEST PROCEDURE**

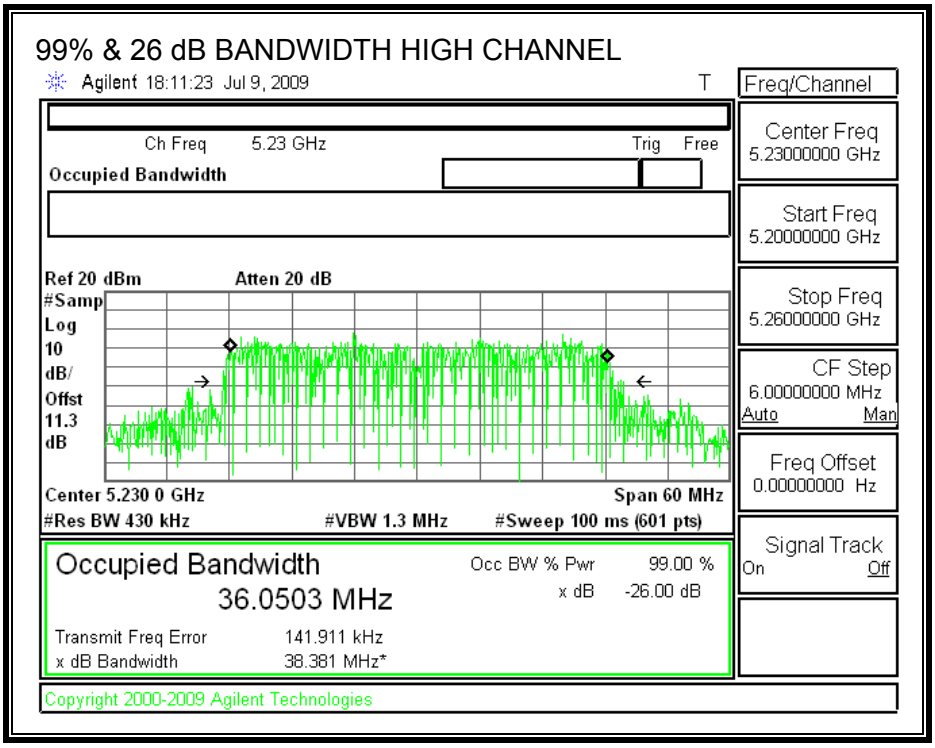
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth measurement function is utilized.

**RESULTS**

| Channel | Frequency (MHz) | 99% OBW (MHz) | 26 dB BW (MHz) |
|---|---|---|---|
| Low | 5190 | 35.5585 | 39.138 |
| High | 5230 | 36.0503 | 38.381 |

**99% & 26 dB BANDWIDTH**



## 7.3.2. OUTPUT POWER

**LIMITS**

FCC §15.407 (a) (2)
IC RSS-210 A9.2 (2)
For the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**TEST PROCEDURE**

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

**RESULTS**

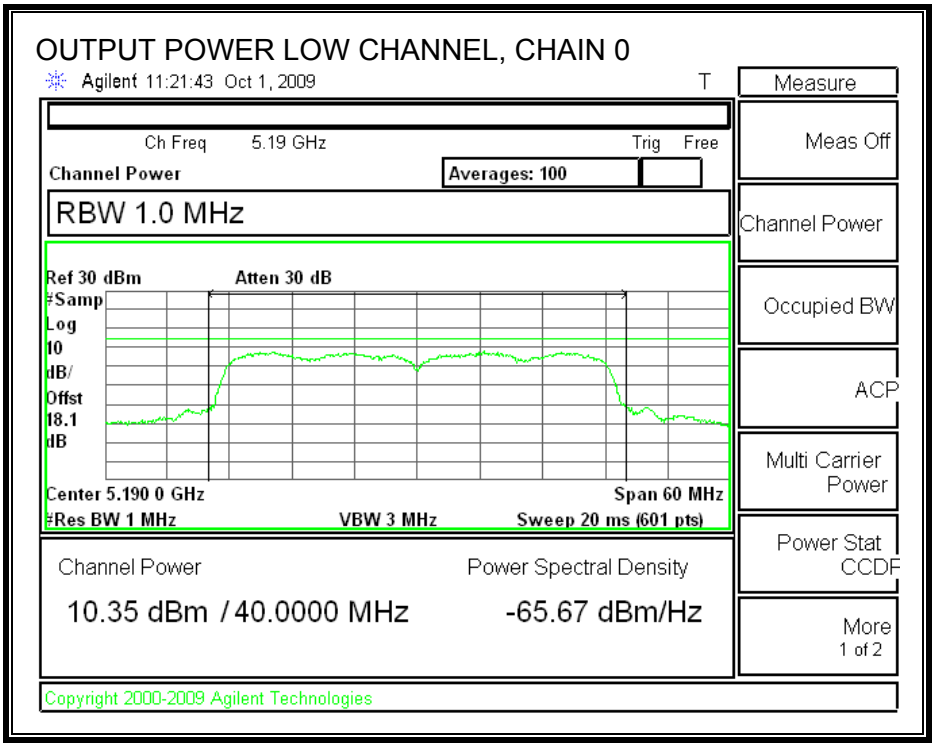
**Limit**

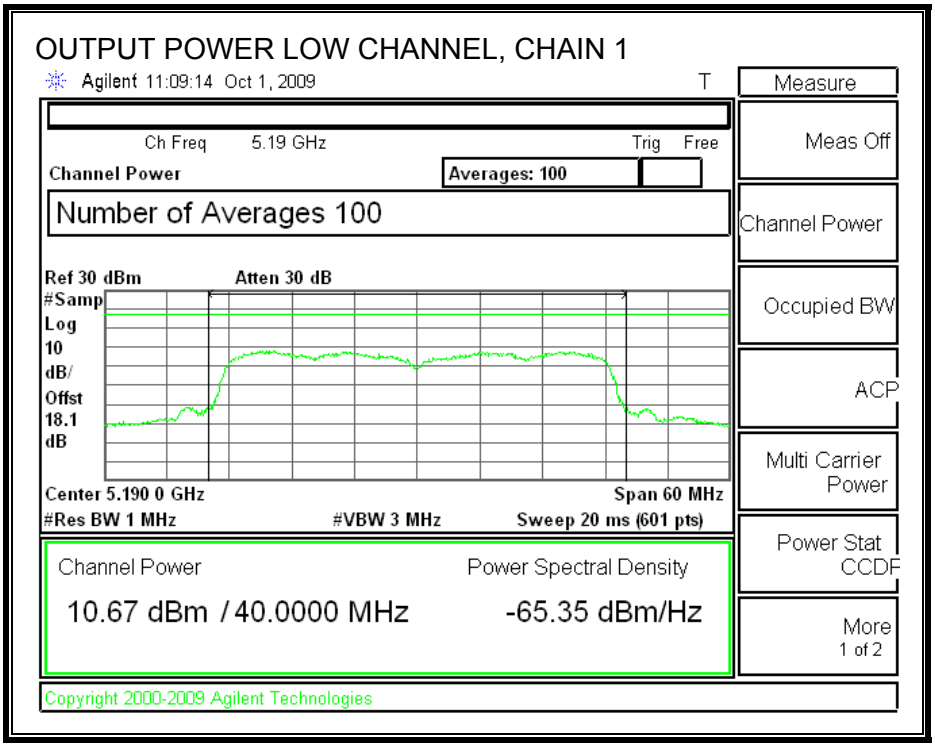
| Channel | Freq (MHz) | Fixed Limit (dBm) | B (MHz) | 4 + 10 Log B Limit (dBm) | Antenna Gain (dBi) | Limit (dBm) |
|---|---|---|---|---|---|---|
| Low | 5190 | 17 | 39.138 | 19.93 | 3 | 17.00 |
| High | 5230 | 17 | 38.381 | 19.84 | 3 | 17.00 |

**Individual Chain Results**

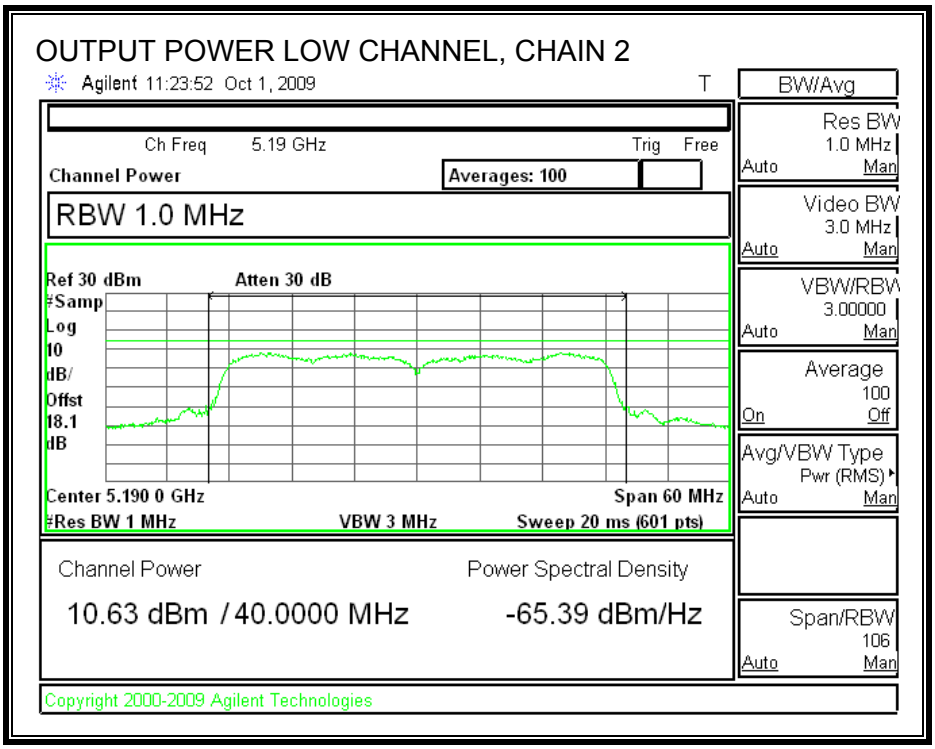
| Channel | Freq (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Chain 3 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| Low | 5190 | 10.35 | 10.67 | 10.63 | 10.87 | 16.65 | 17.00 | -0.35 |
| High | 5230 | 10.56 | 10.79 | 10.54 | 10.70 | 16.67 | 17.00 | -0.33 |

**OUTPUT POWER, LOW CHANNEL**

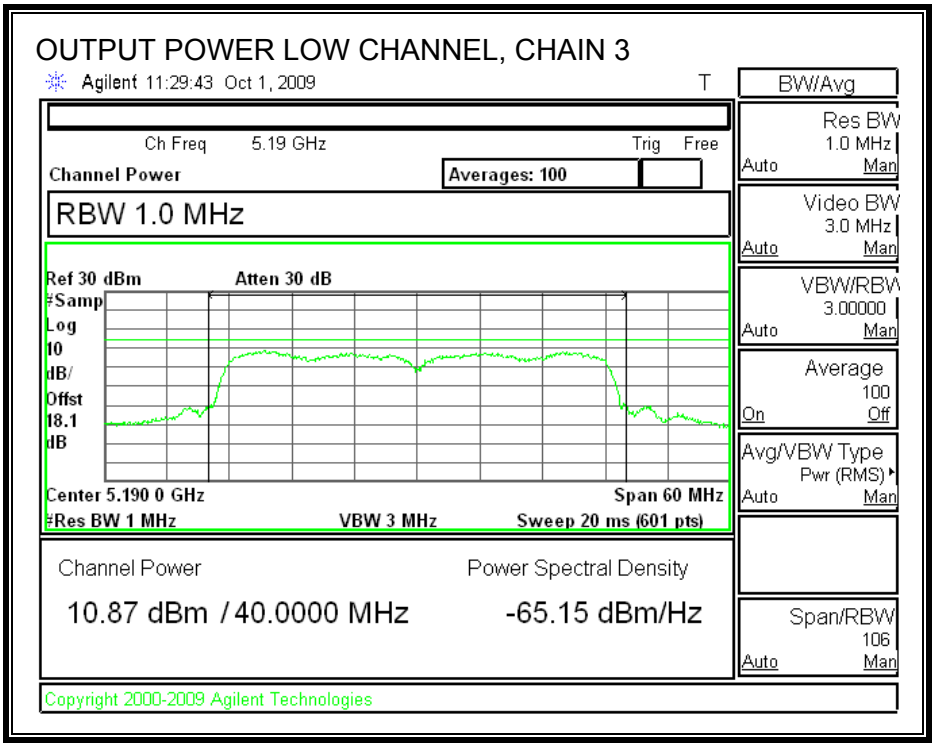


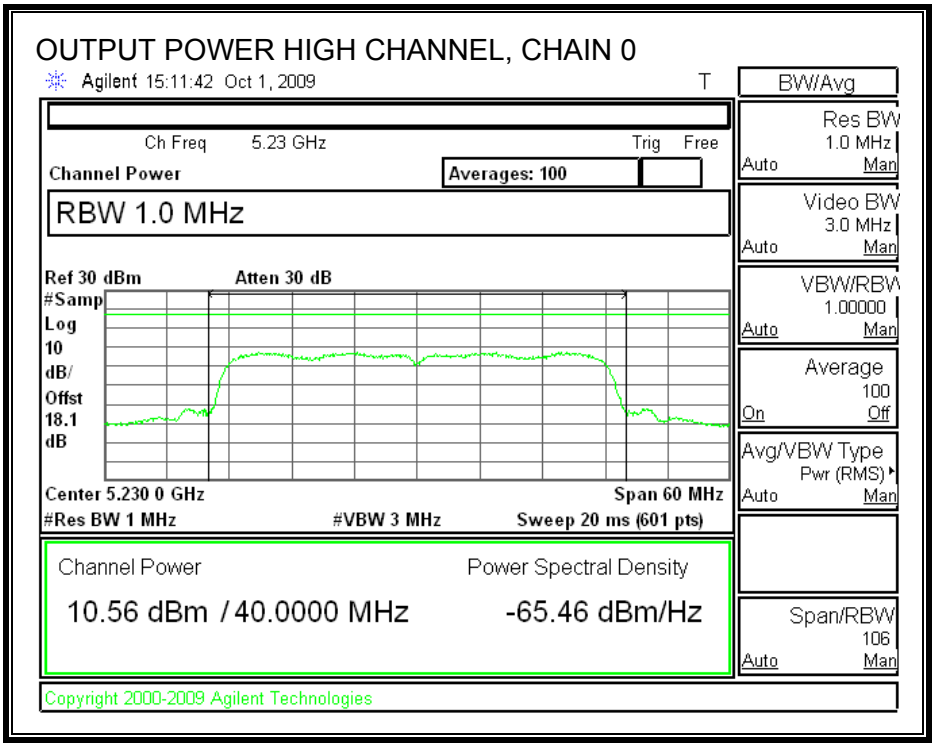
OUTPUT POWER LOW CHANNEL, CHAIN 2

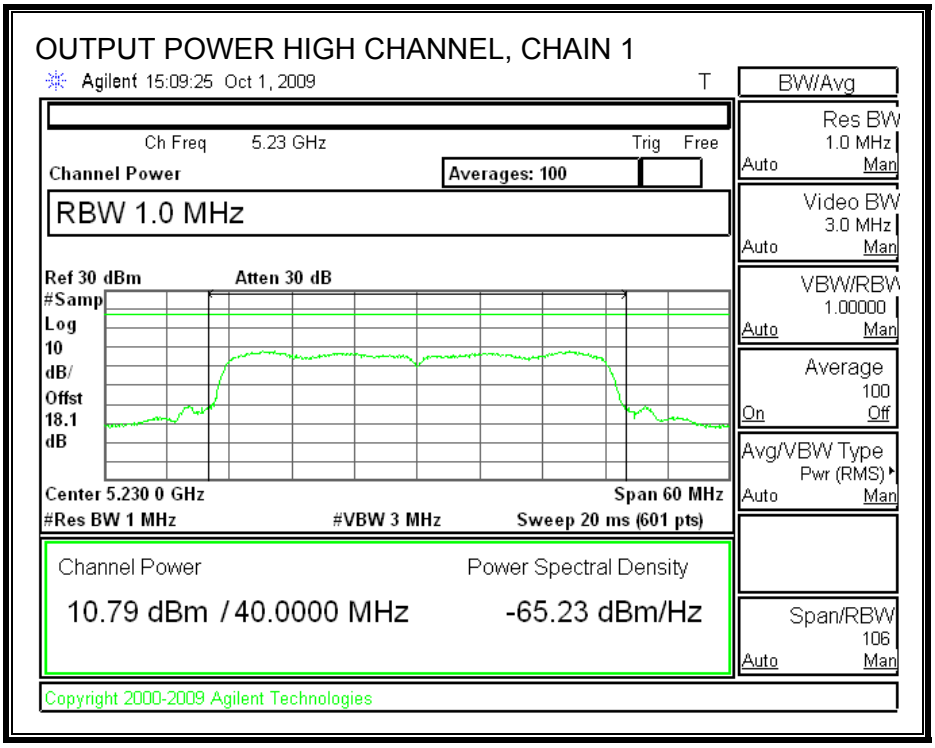



OUTPUT POWER LOW CHANNEL, CHAIN 3

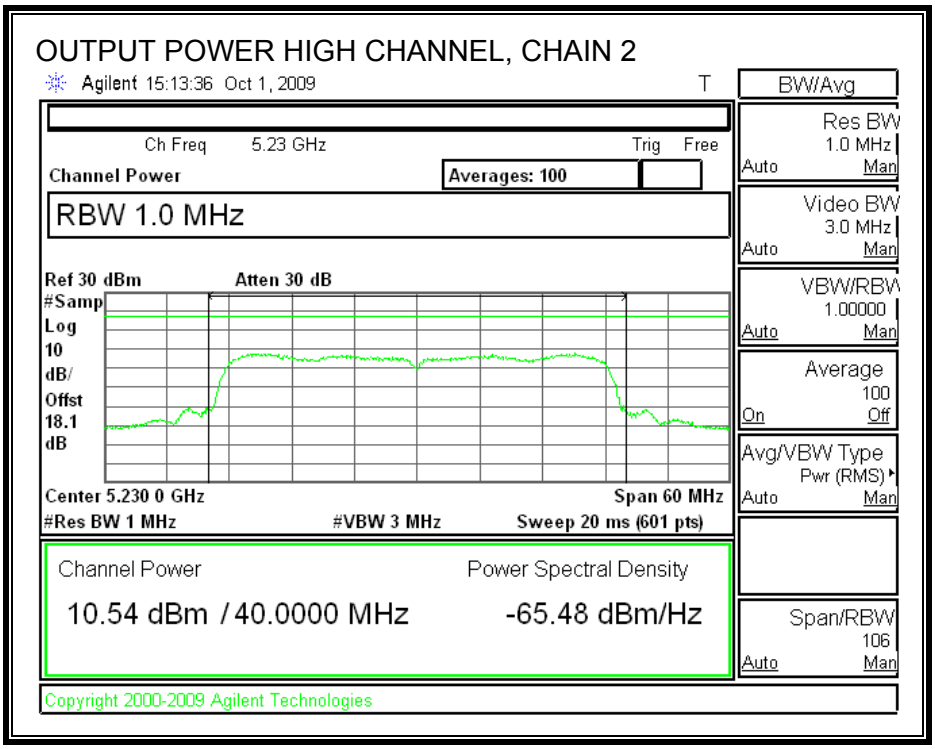


**OUTPUT POWER, HIGH CHANNEL**

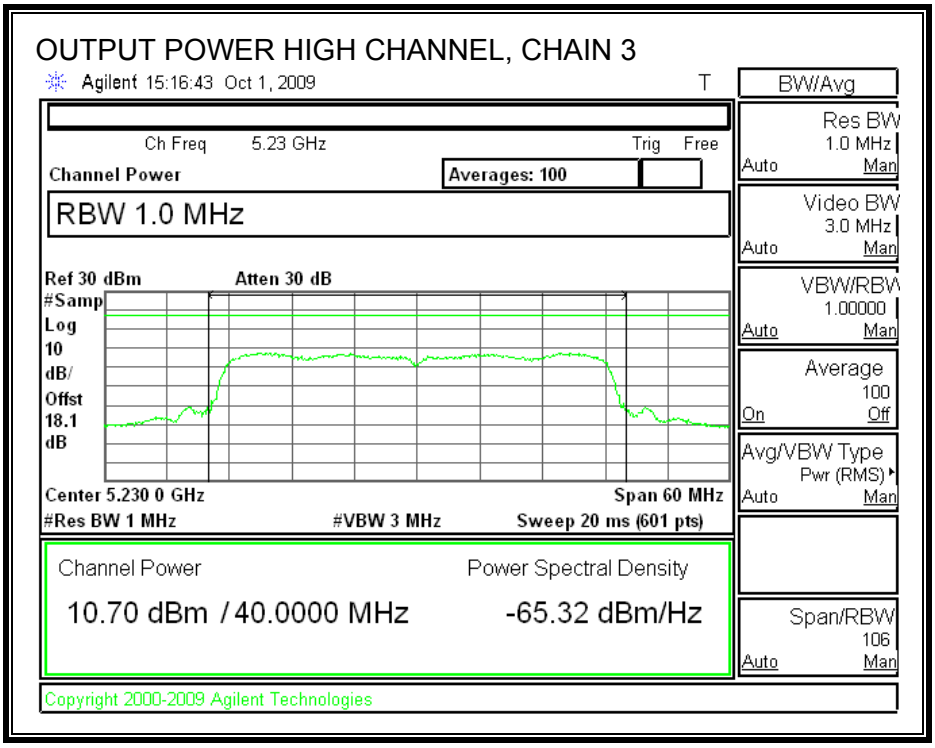


OUTPUT POWER HIGH CHANNEL, CHAIN 2




OUTPUT POWER HIGH CHANNEL, CHAIN 3



## 7.3.3. AVERAGE POWER

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.3 dB (including 10 dB pad and 1.3 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

**RESULTS**

| Frequency (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Chain 3 Power (dBm) |
|---|---|---|---|---|
| 5190 | 10.57 | 10.98 | 10.59 | 10.82 |
| 5230 | 10.47 | 10.70 | 10.52 | 10.66 |

## 7.3.4. PEAK POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.15-5.25 GHz band, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is less than 6 dBi; therefore the limit is 4 dBm.

**TEST PROCEDURE**

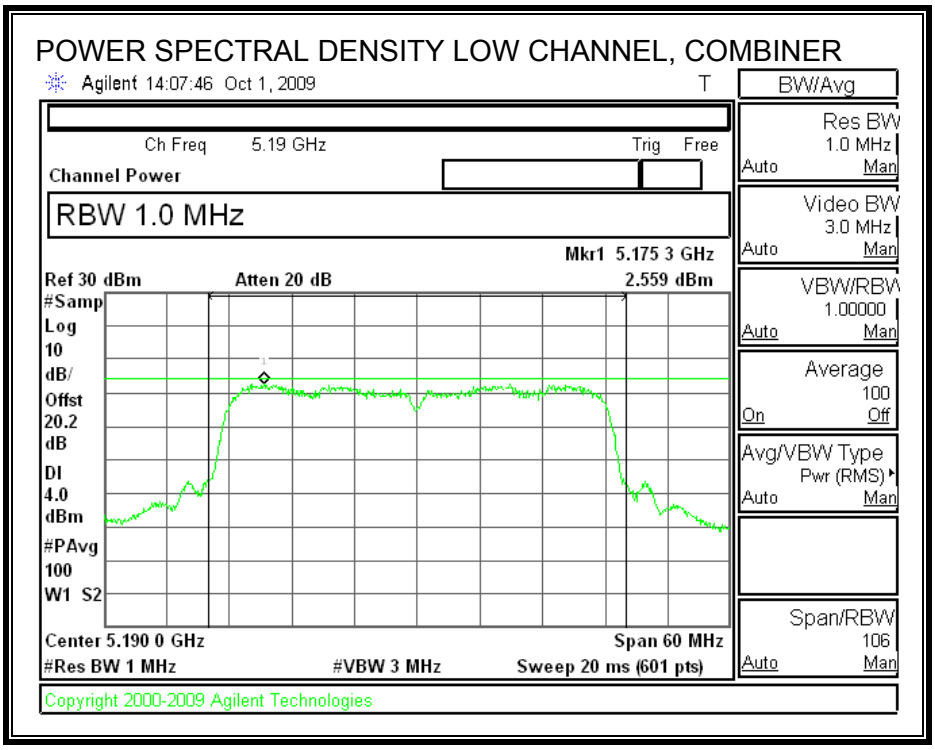
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

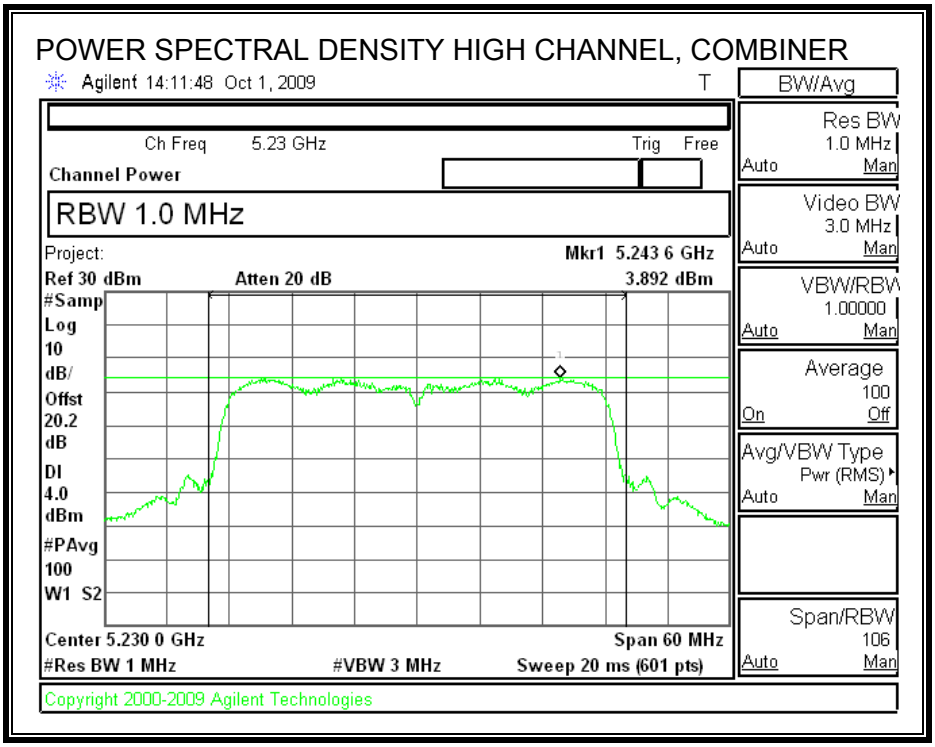
Preliminary tests on individual chains, and on all chains with a combiner, were performed. The worst-case configuration was with a combiner, therefore final test were performed with all chains feeding a combiner.

**RESULTS**

| Channel | Frequency (MHz) | PSD with Combiner (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 5190 | 2.559 | 4 | -1.44 |
| High | 5230 | 3.892 | 4 | -0.11 |

**POWER SPECTRAL DENSITY**



## 7.3.5. PEAK EXCURSION

**LIMITS**

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

**TEST PROCEDURE**

The transmitter outputs are connected to the spectrum analyzer via a combiner.

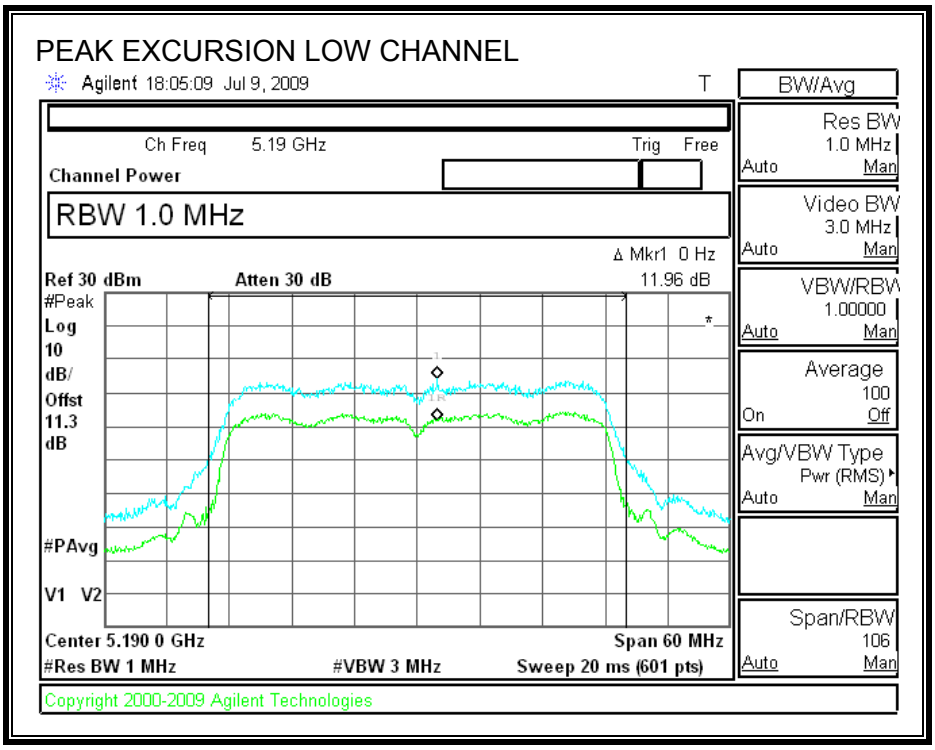
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

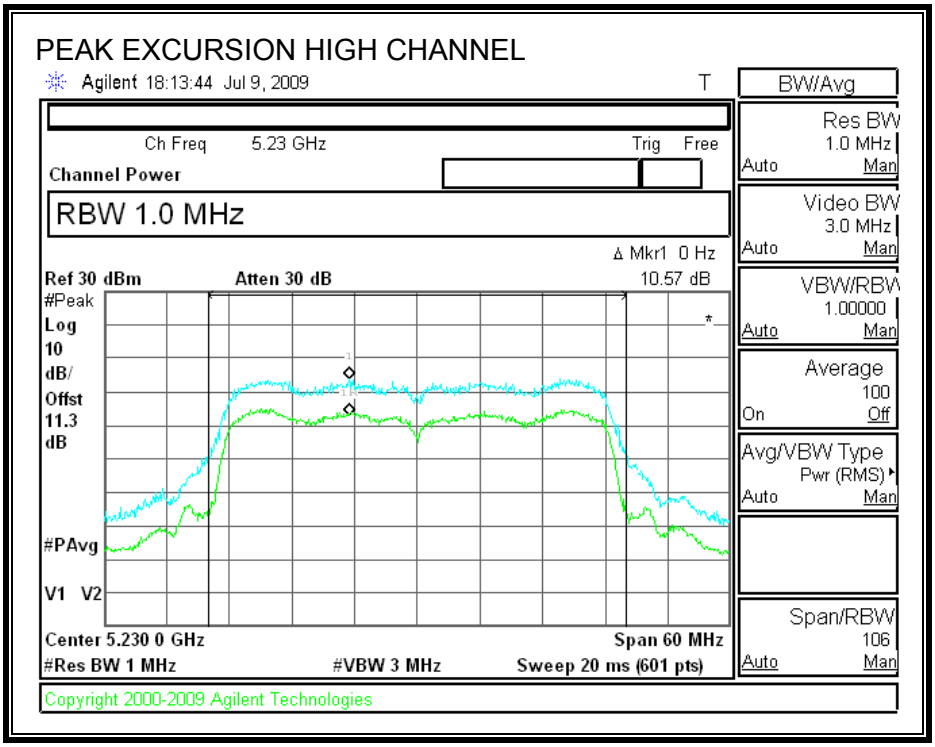
Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

**RESULTS**

| Channel | Frequency (MHz) | Peak Excursion (dB) | Limit (dB) | Margin (dB) |
|---|---|---|---|---|
| Low | 5190 | 11.96 | 13 | -1.04 |
| High | 5230 | 10.57 | 13 | -2.43 |

**PEAK EXCURSION**



## 7.3.6. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.407 (b) (3)

IC RSS-210 A9.3 (3)

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

**TEST PROCEDURE**

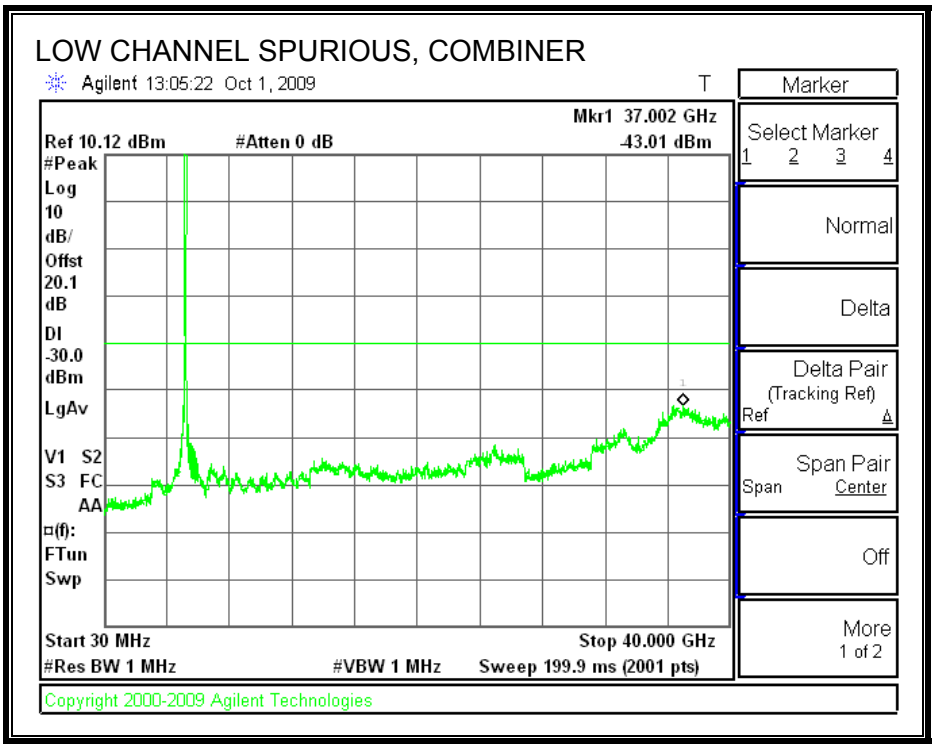
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

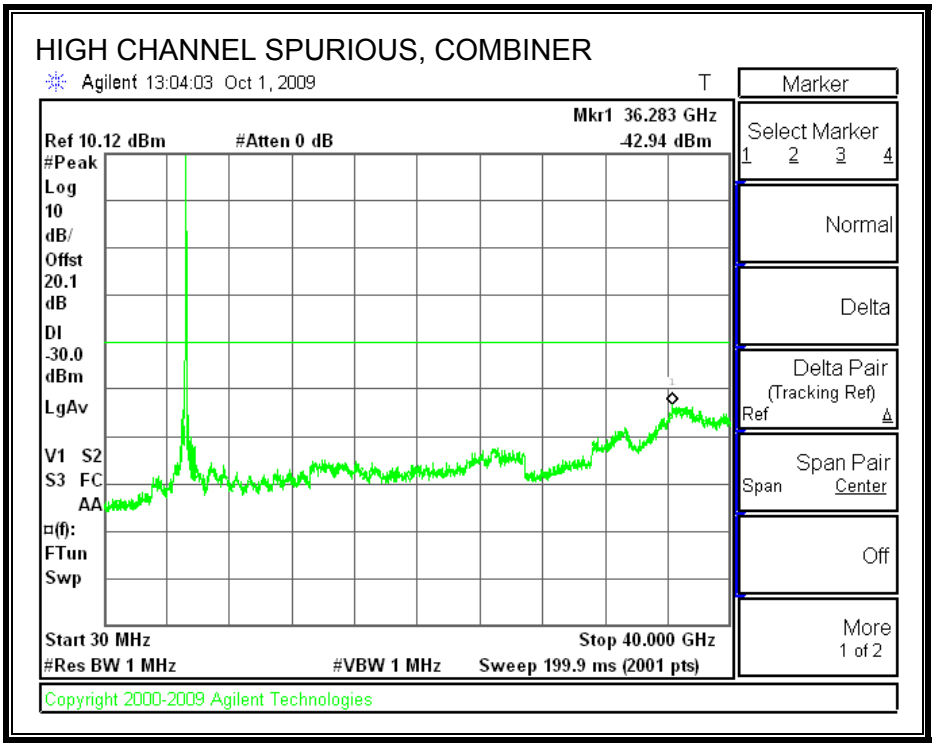
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

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

**LOW CHANNEL SPURIOUS EMISSIONS**




**HIGH CHANNEL SPURIOUS EMISSIONS**



## 7.4. 5.3 GHz BAND CHANNEL TESTS FOR 802.11a MODE

### 7.4.1. 26 dB and 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

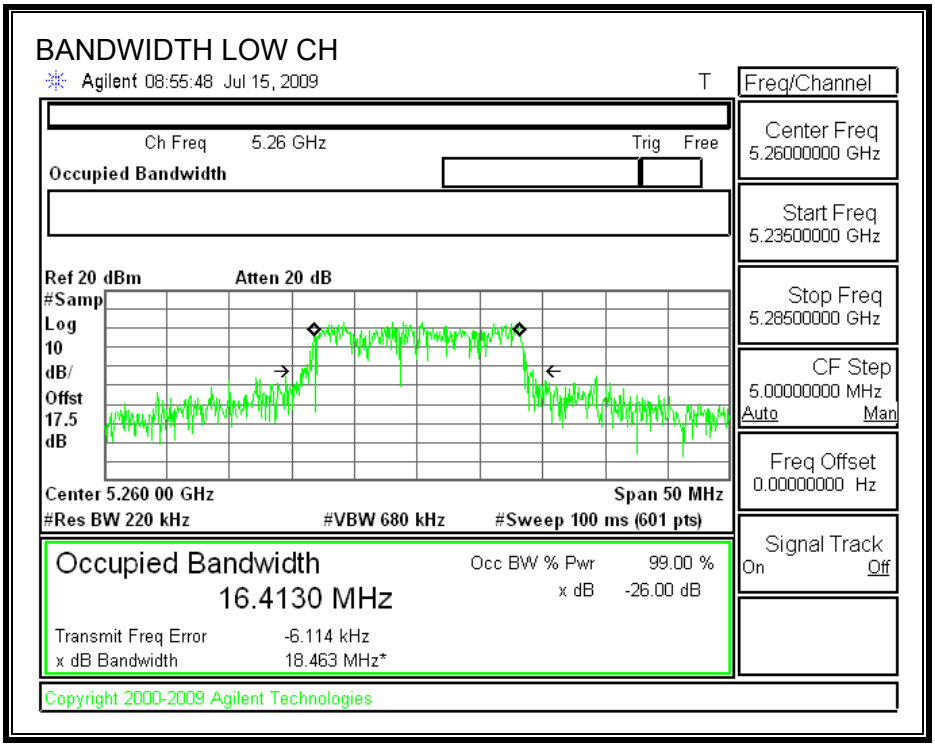
**TEST PROCEDURE**

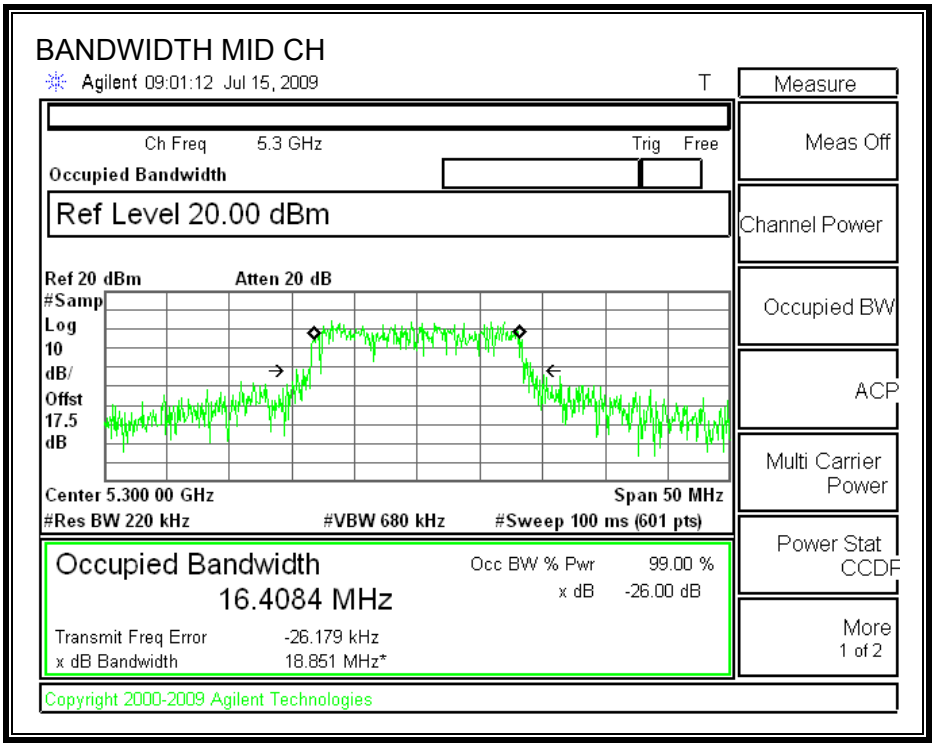
The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

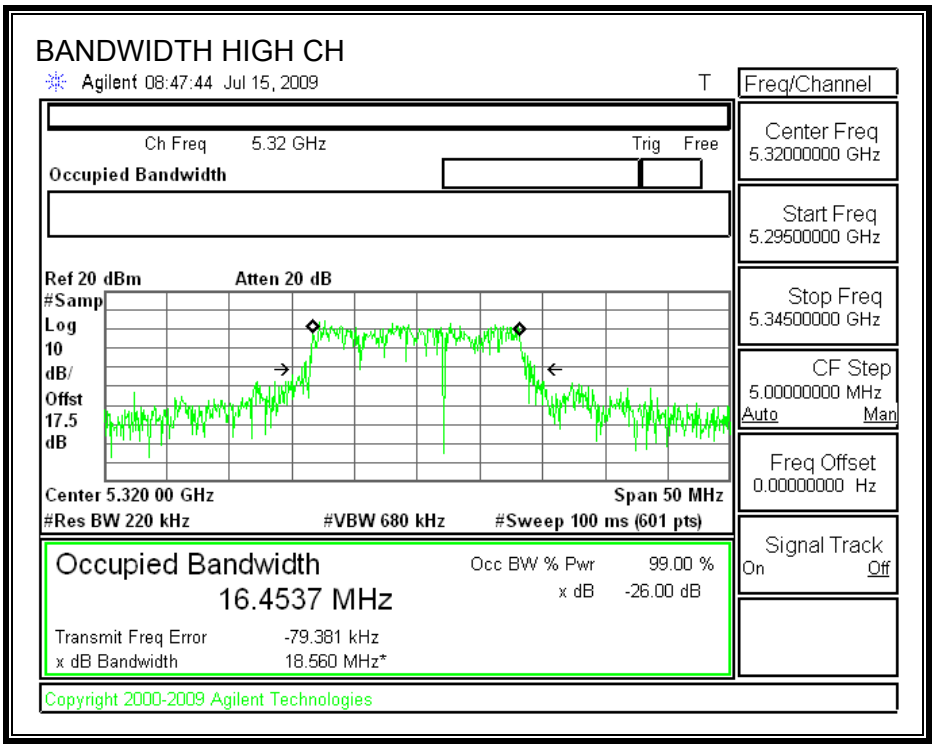
**RESULTS**

| Channel | Frequency (MHz) | 26 dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|---|---|---|---|
| Low | 5260 | 18.4630 | 16.4130 |
| Middle | 5300 | 18.8510 | 16.4084 |
| High | 5320 | 18.5600 | 16.4537 |

**26 dB and 99% BANDWIDTH**





## 7.4.2. OUTPUT POWER

**LIMITS**

FCC §15.407 (a) (1)
IC RSS-210 A9.2 (1)

Antenna gain of Chain 1 = antenna gain of Chain 2.

| Antenna Gain (dBi) | 10 Log (# Tx Chains) (dB) | Effective Legacy Gain (dBi) |
|---|---|---|
| 3 | 3.01 | 6.01 |

For the 5.25-5.35 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**TEST PROCEDURE**

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.
The transmitter output operates continuously therefore Method # 1 is used.

**RESULTS**

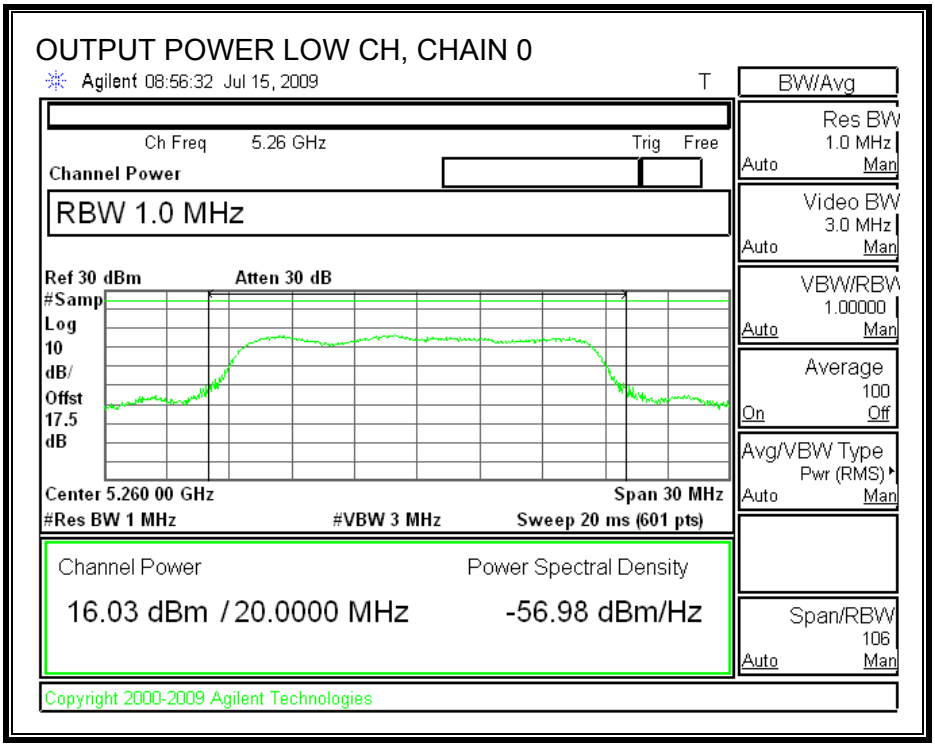
**Limit**

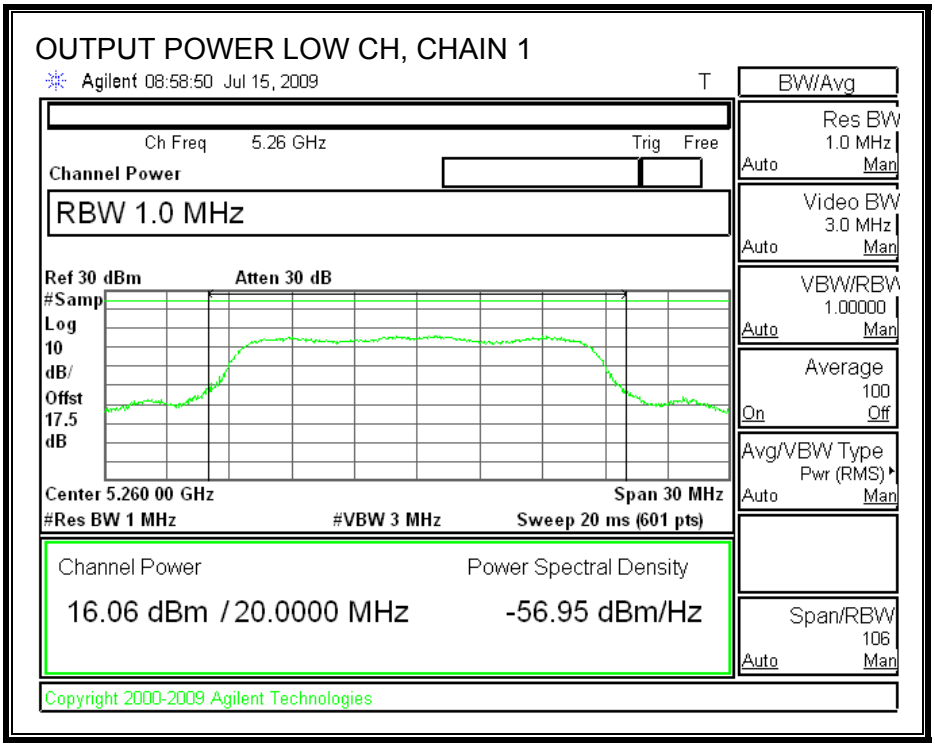
| Channel | Frequency (MHz) | Fixed Limit (dBm) | B (MHz) | 11 + 10 Log B Limit (dBm) | Effective Ant Gain (dBi) | Limit (dBm) |
|---|---|---|---|---|---|---|
| Low | 5260 | 24 | 18.4630 | 23.66 | 6.01 | 23.65 |
| Mid | 5300 | 24 | 18.8510 | 23.75 | 6.01 | 23.74 |
| High | 5320 | 24 | 18.5600 | 23.69 | 6.01 | 23.68 |

**Individual Chain Results**

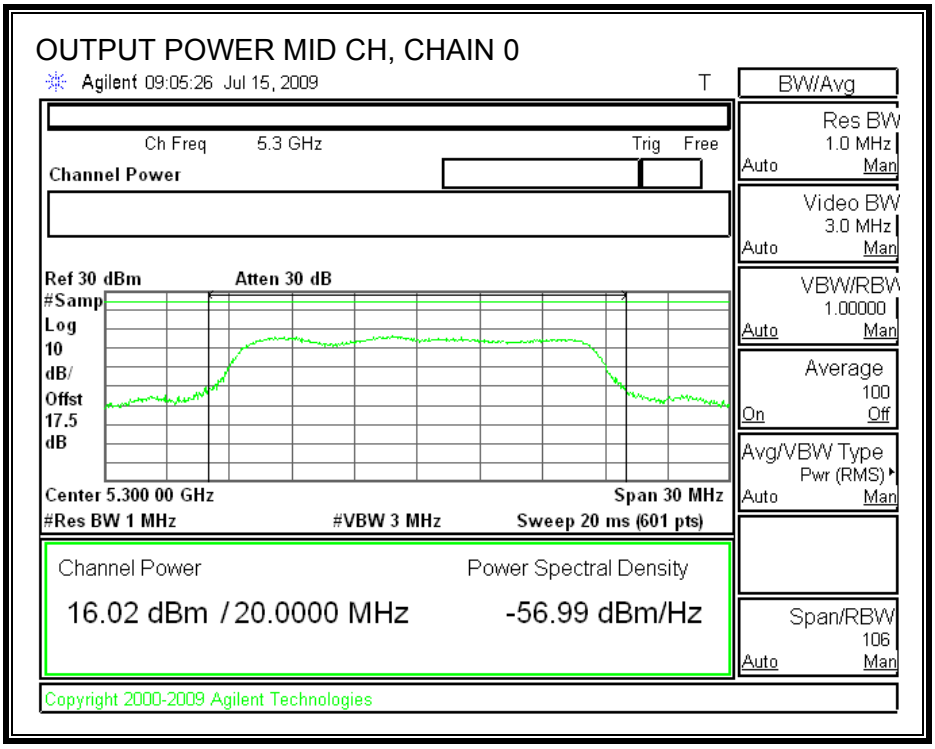
| Channel | Frequency (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|
| Low | 5260 | 16.03 | 16.06 | 19.06 | 23.65 | -4.60 |
| Mid | 5300 | 16.02 | 16.25 | 19.15 | 23.74 | -4.60 |
| High | 5320 | 16.08 | 16.09 | 19.10 | 23.68 | -4.58 |

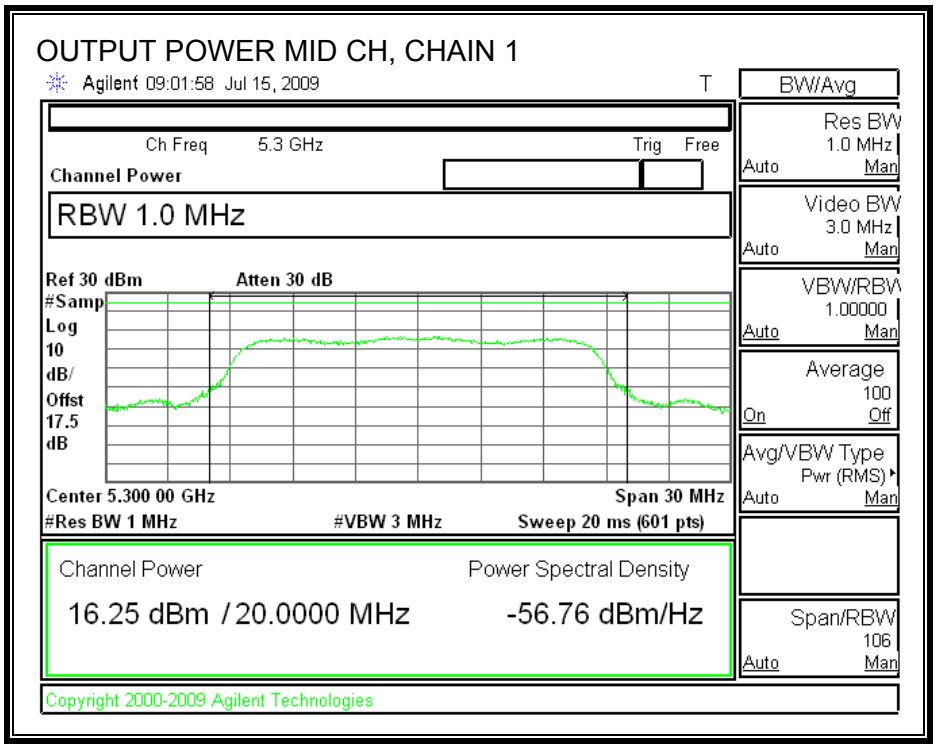
**OUTPUT POWER, LOW CHANNEL**



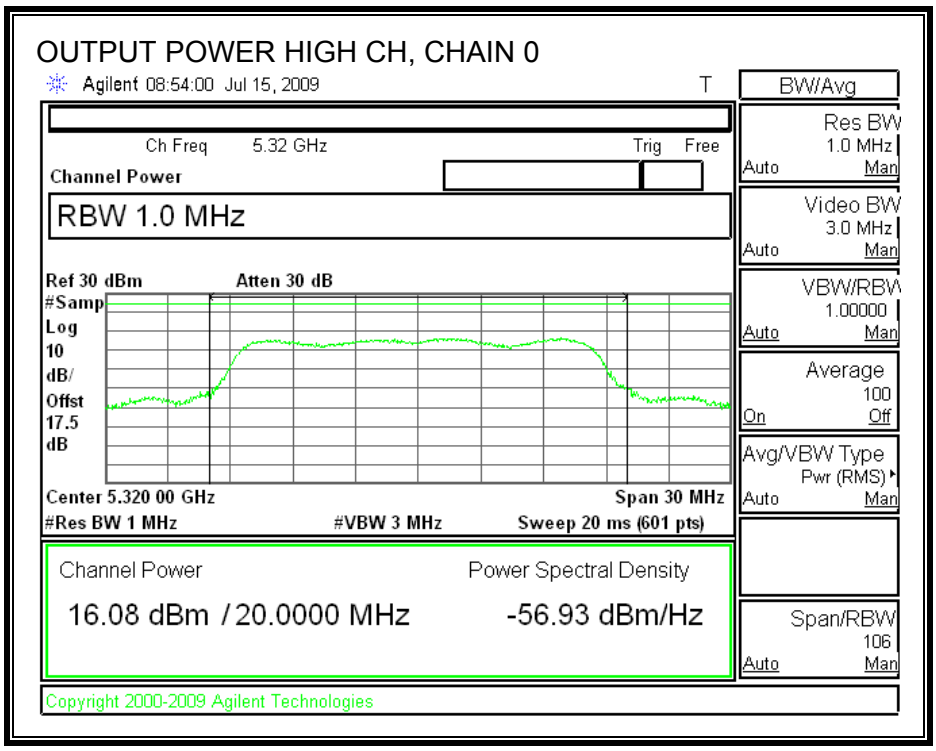



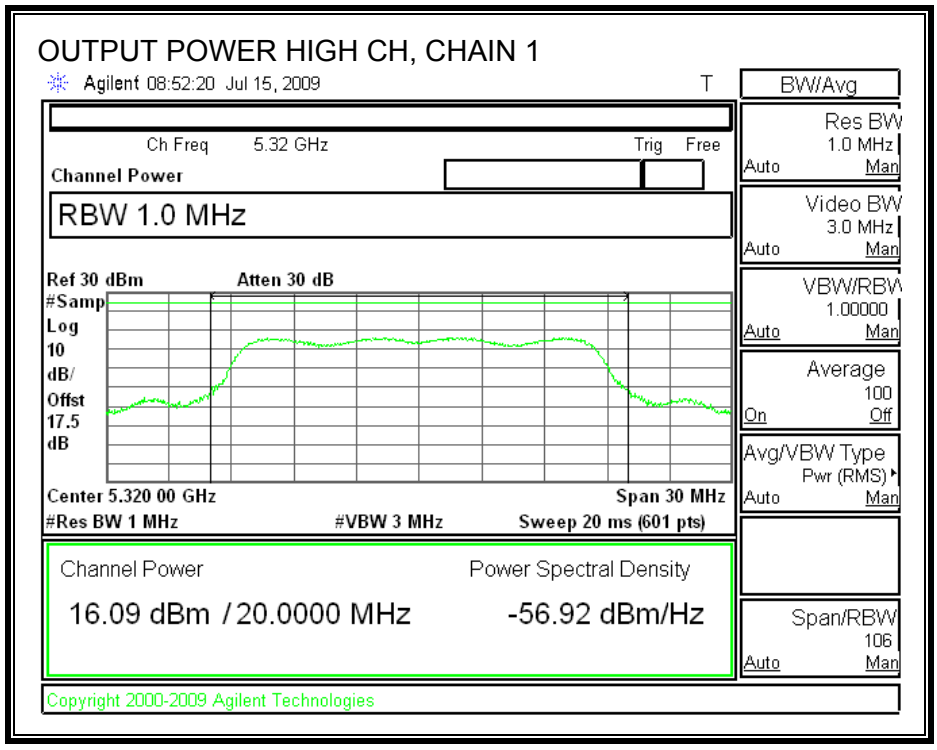
**OUTPUT POWER, MID CHANNEL**



**OUTPUT POWER, HIGH CHANNEL**



## 7.4.3. AVERAGE POWER

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a power meter.

**RESULTS**

The cable assembly insertion loss of 11.3 dB (including 10 dB pad and 1.3 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) | Total Power (dBm) |
|---|---|---|---|---|
| Low | 5260 | 15.94 | 16.16 | 19.06 |
| Middle | 5300 | 16.14 | 16.32 | 19.24 |
| High | 5320 | 16.05 | 16.25 | 19.16 |

## 7.4.4. PEAK POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

Use this table if antenna gain for Chain 1 = antenna gain for Chain 2

| Antenna Gain (dBi) | 10 Log (# Tx Chains) (dB) | Effective Legacy Gain (dBi) |
|---|---|---|
| 3 | 3.01 | 6.01 |

For the 5.25–5.35 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum effective antenna gain is 6.01 dBi, therefore the limit is 10.99 dBm.

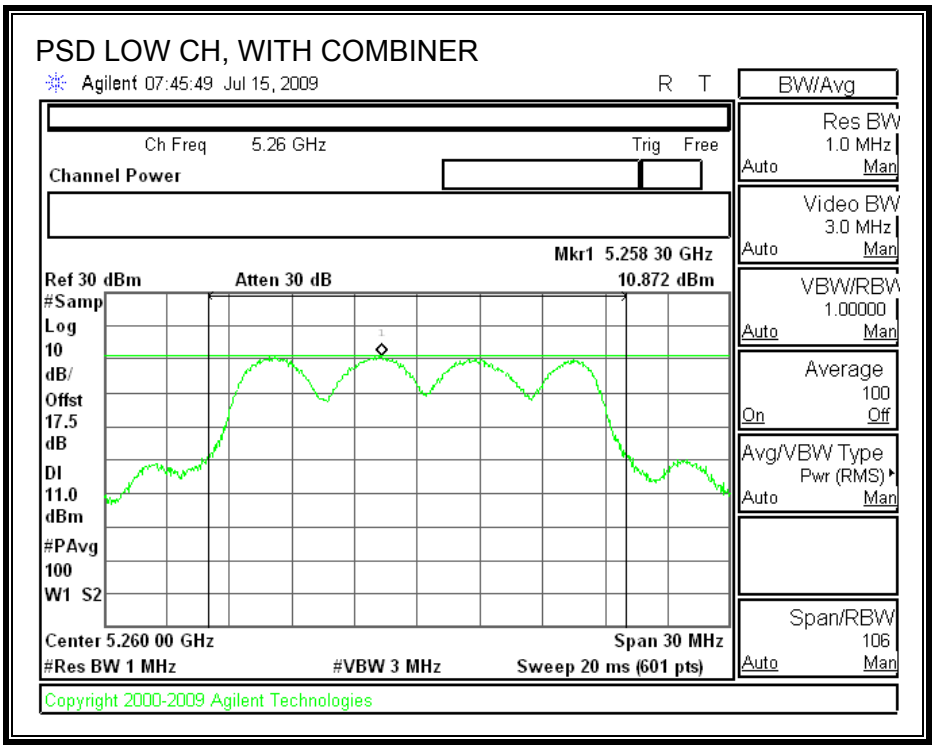
**TEST PROCEDURE**

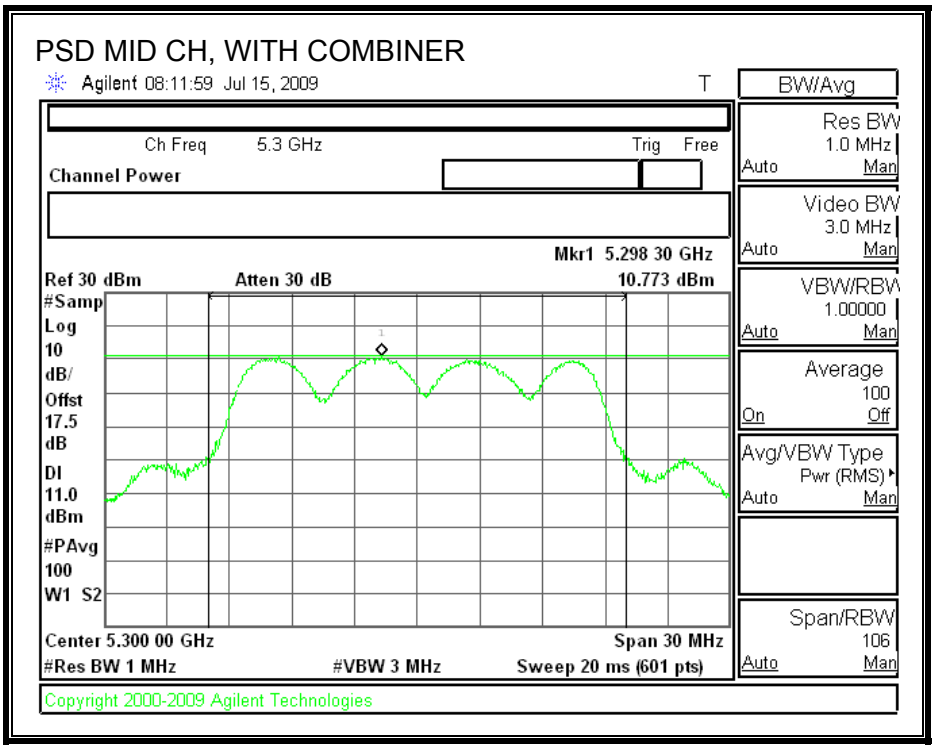
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

**RESULTS**

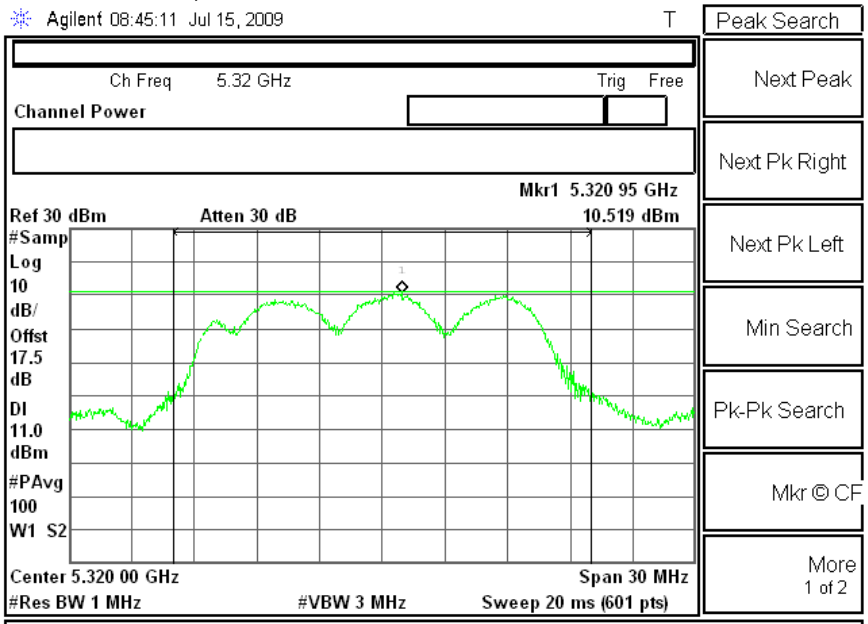
| Channel | Frequency (MHz) | PPSD With Combiner (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| **Low** | **5260** | **10.87** | **10.99** | **-0.12** |
| **Middle** | **5300** | **10.77** | **10.99** | **-0.22** |
| **High** | **5320** | **10.52** | **10.99** | **-0.47** |

**POWER SPECTRAL DENSITY WITH COMBINER**



PSD HIGH CH, WITH COMBINER



## 7.4.5. PEAK EXCURSION

**LIMITS**

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

**TEST PROCEDURE**

The transmitter outputs are connected to the spectrum analyzer via a combiner.

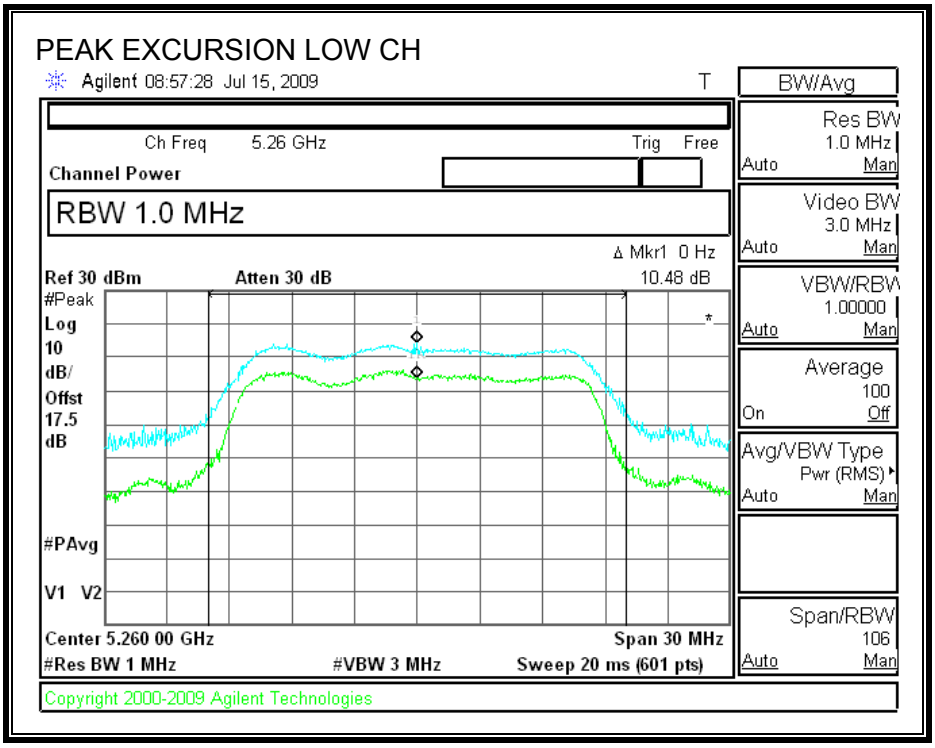
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

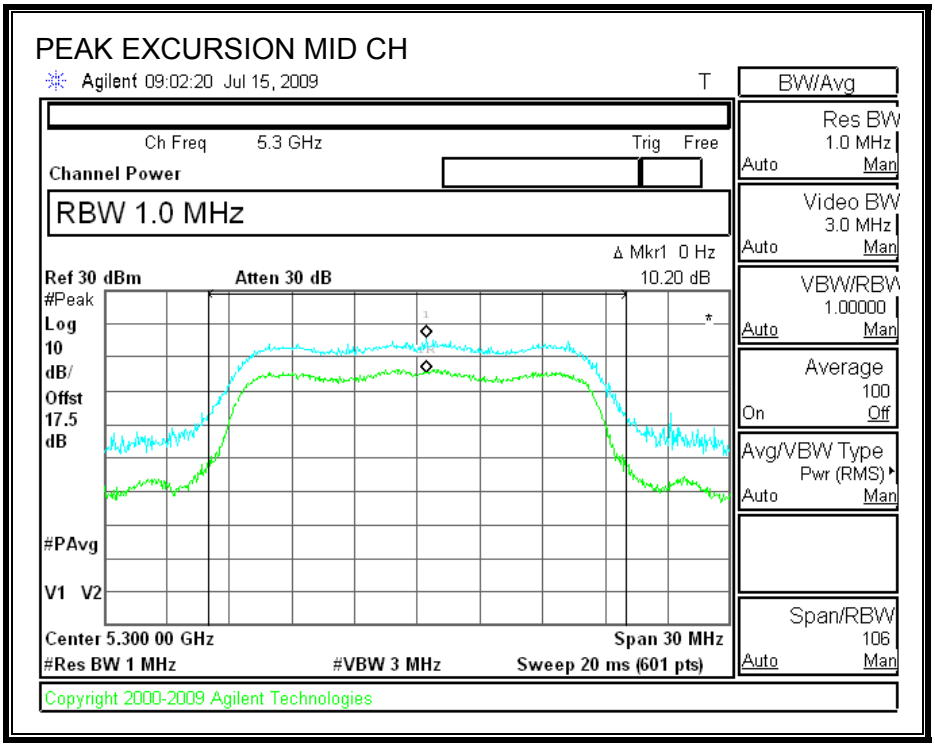
Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

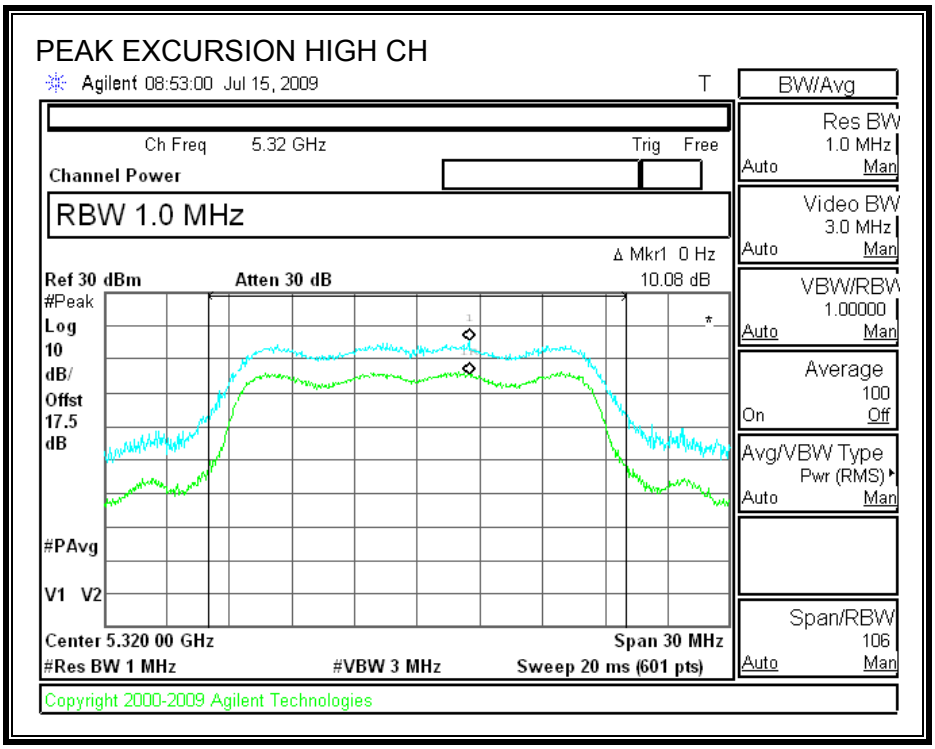
**RESULTS**

| Channel | Frequency (MHz) | Peak Excursion (dB) | Limit (dB) | Margin (dB) |
|---|---|---|---|---|
| Low | 5260 | 10.48 | 13 | -2.52 |
| Middle | 5300 | 10.20 | 13 | -2.80 |
| High | 5320 | 10.08 | 13 | -2.92 |

**PEAK EXCURSION**





## 7.4.6. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.407 (b) (1)

IC RSS-210 A9.3 (1)

For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.25-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

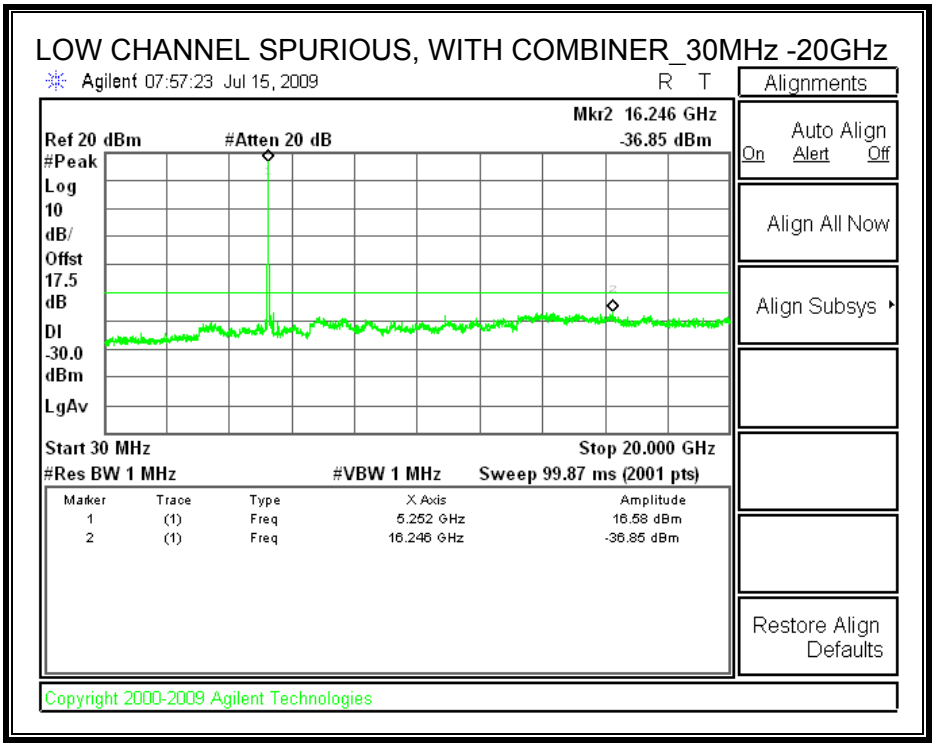
**TEST PROCEDURE**

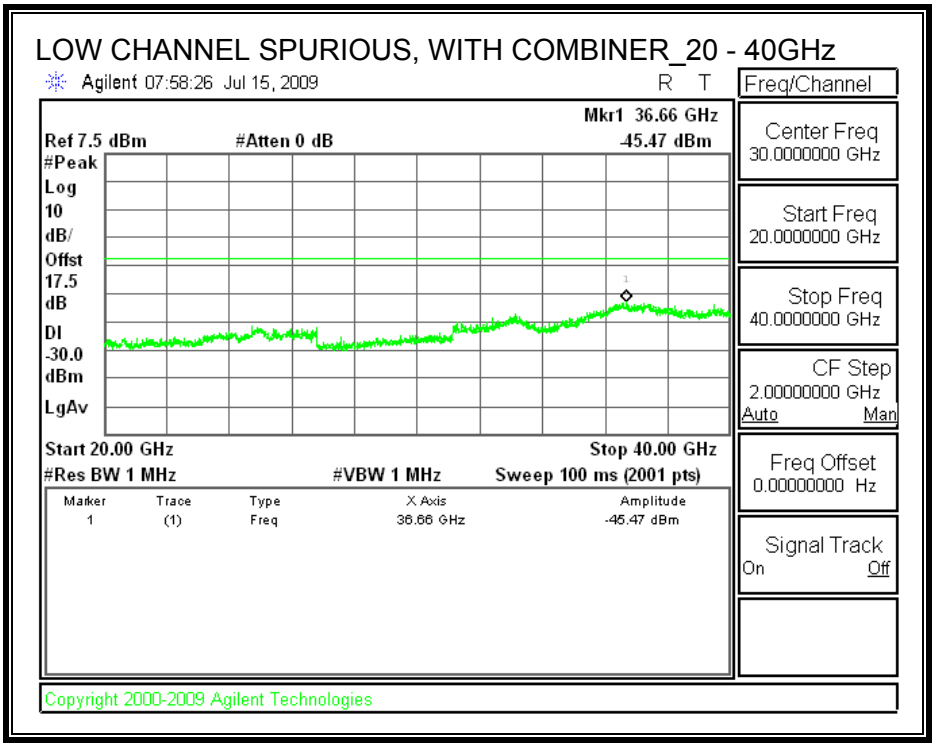
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

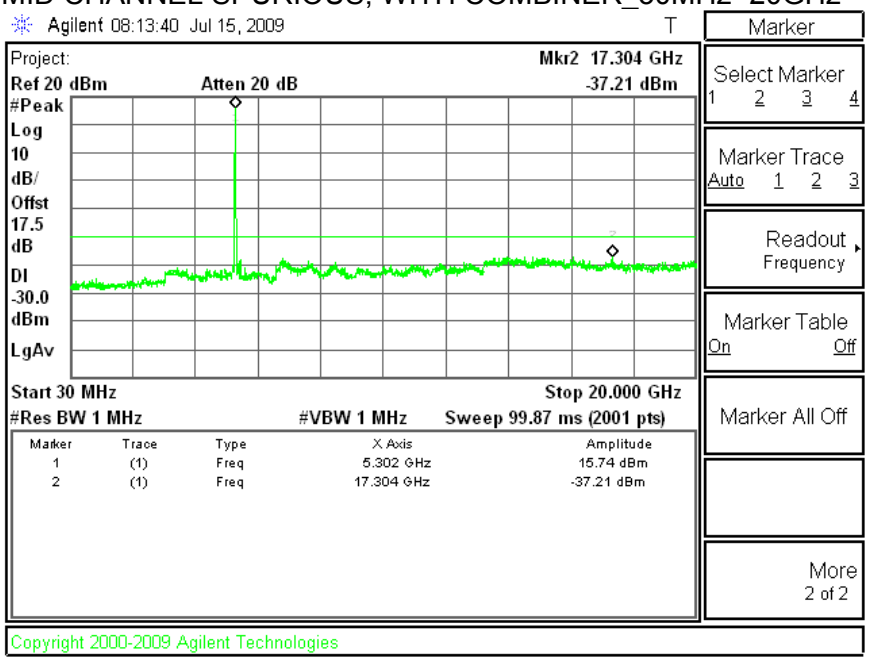
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

**SPURIOUS EMISSIONS WITH COMBINER**

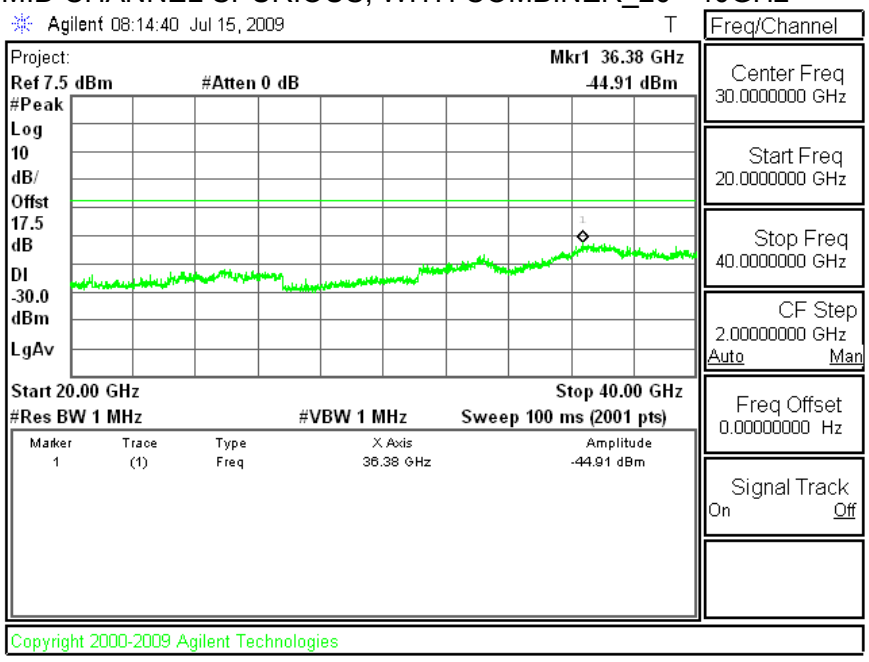


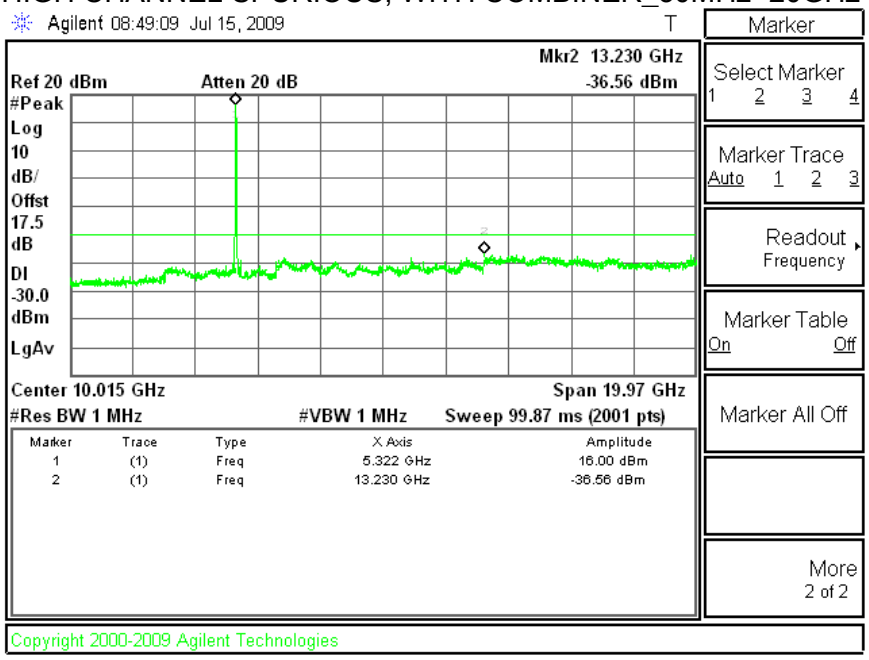
MID CHANNEL SPURIOUS, WITH COMBINER_30MHz -20GHz



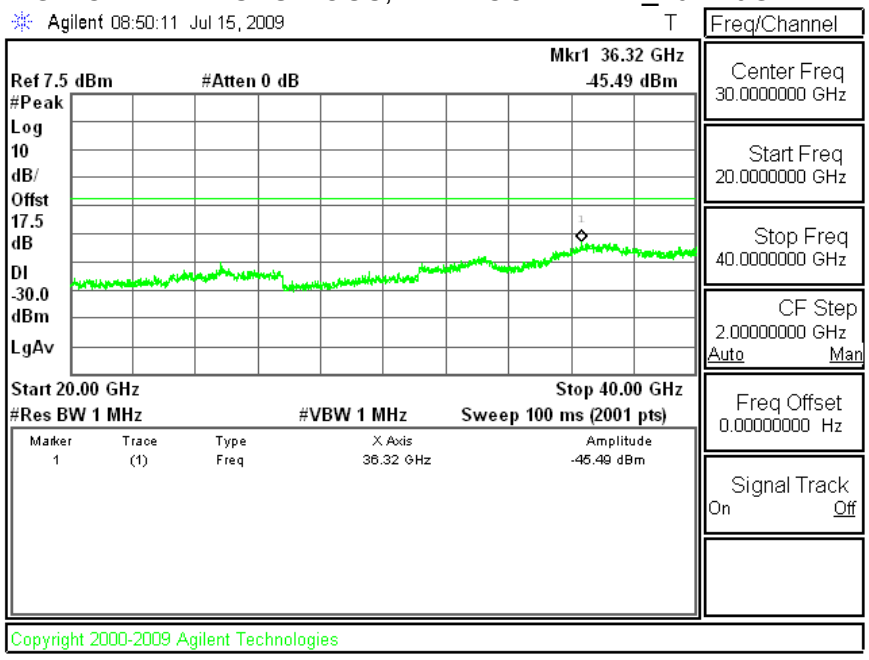

MID CHANNEL SPURIOUS, WITH COMBINER_20 - 40GHz



HIGH CHANNEL SPURIOUS, WITH COMBINER_30MHz -20GHz




HIGH CHANNEL SPURIOUS, WITH COMBINER_20 - 40GHz



# 7.5. 5.3 GHz BAND CHANNEL TESTS FOR 802.11n HT20 MODE

## 7.5.1. 99% & 26 dB BANDWIDTH

**LIMITS**

None; for reporting purposes only.

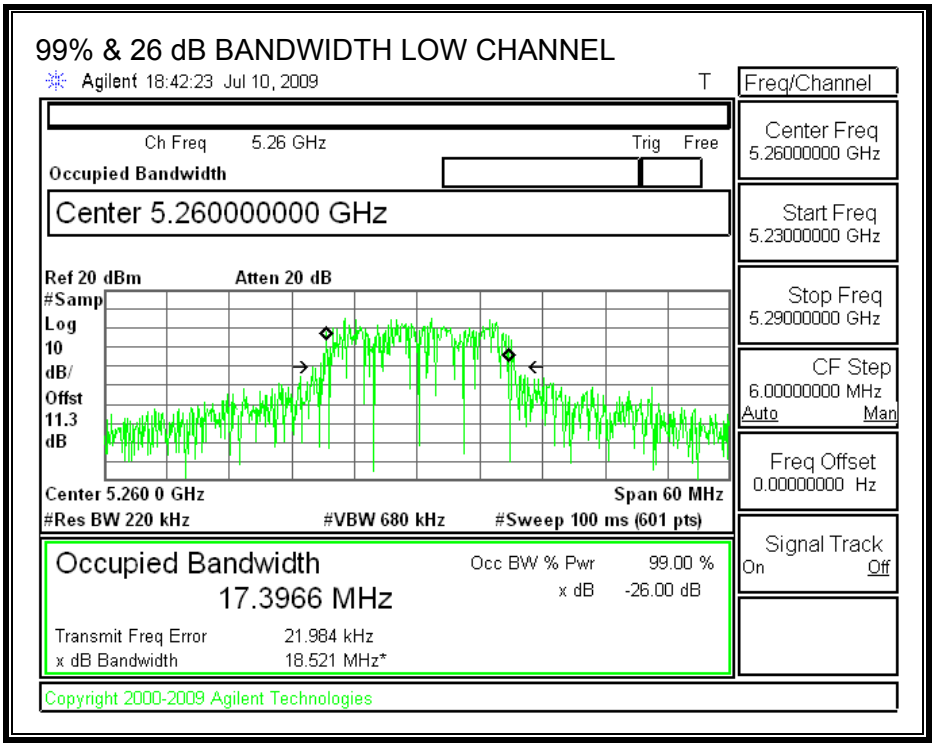
**TEST PROCEDURE**

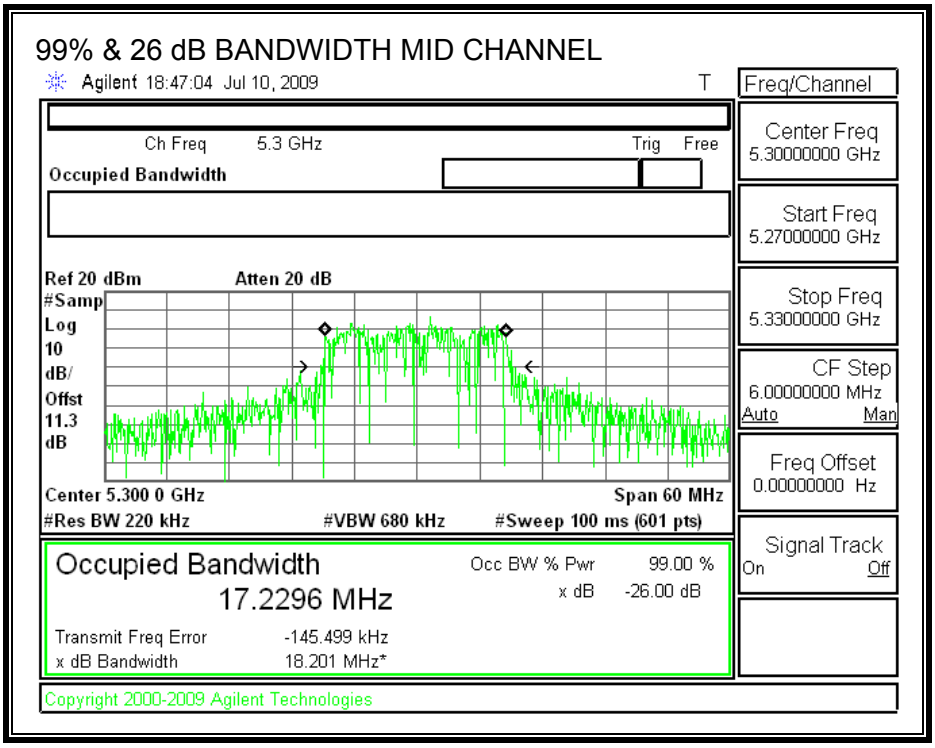
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth measurement function is utilized.

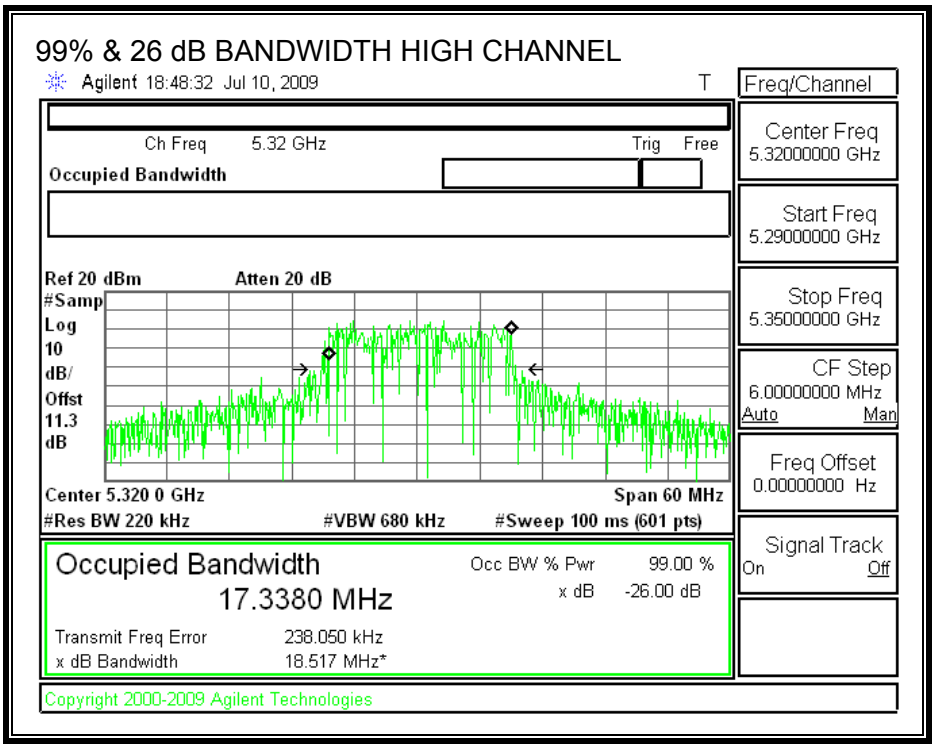
**RESULTS**

| Channel | Frequency (MHz) | 99% OBW (MHz) | 26 dB BW (MHz) |
|---|---|---|---|
| Low | 5260 | 17.3966 | 18.521 |
| Middle | 5300 | 17.2296 | 18.201 |
| High | 5320 | 17.3380 | 18.517 |

**99% & 26 dB BANDWIDTH**





## 7.5.2. OUTPUT POWER

**LIMITS**

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.25-5.35 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**TEST PROCEDURE**

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

**RESULTS**

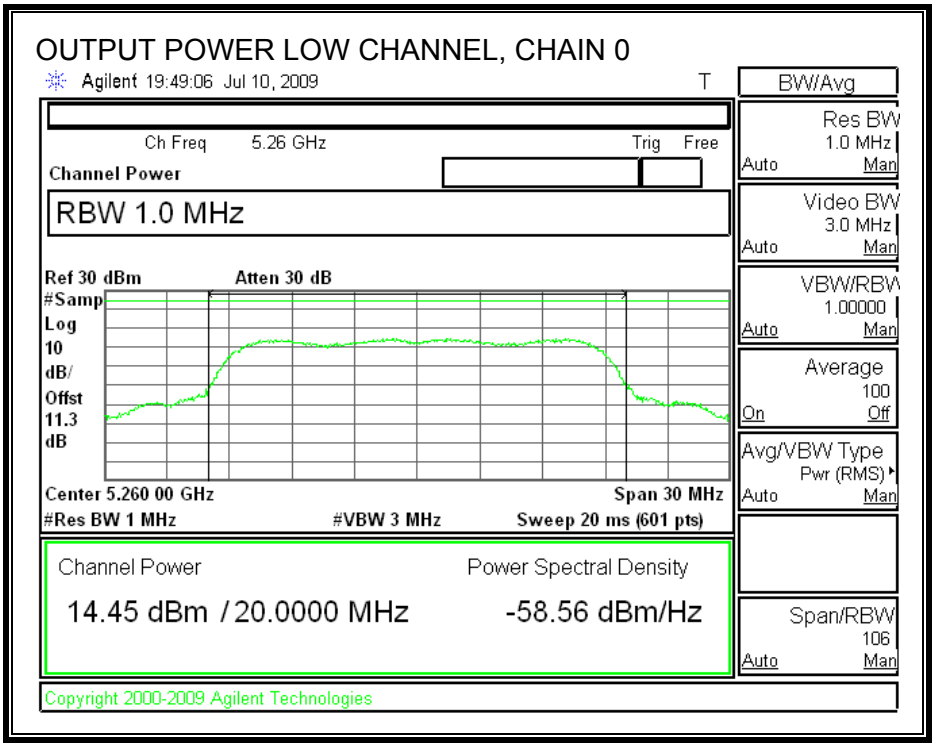
**Limit**

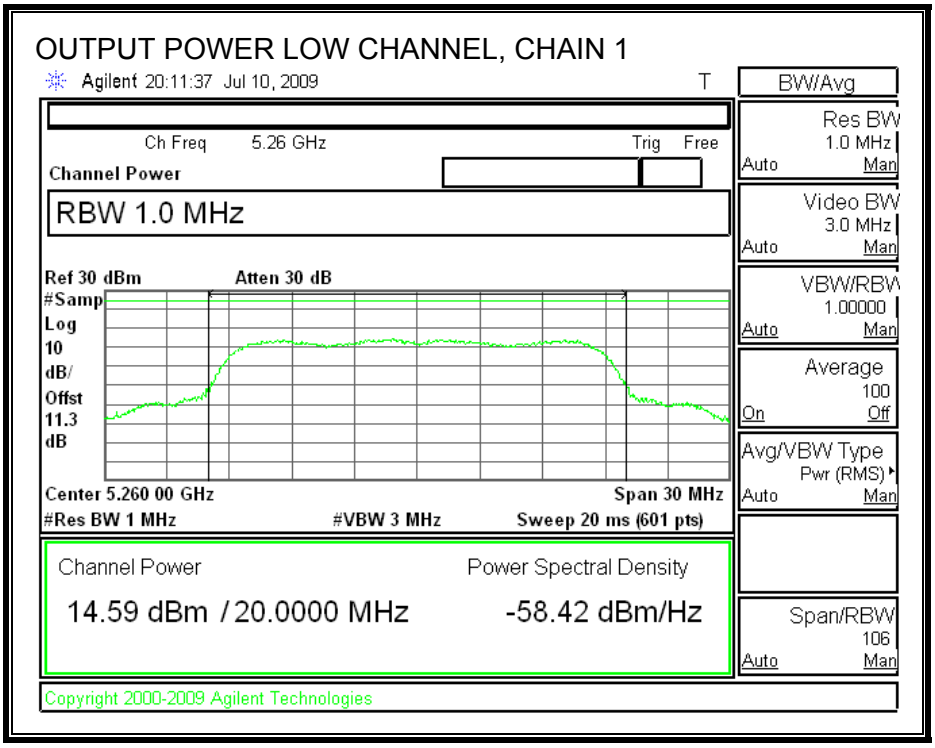
| Channel | Freq (MHz) | Fixed Limit (dBm) | B (MHz) | 4 + 10 Log B Limit (dBm) | Antenna Gain (dBi) | Limit (dBm) |
|---|---|---|---|---|---|---|
| Low | 5260 | 24 | 18.520 | 23.68 | 3 | 23.68 |
| Mid | 5300 | 24 | 18.201 | 23.60 | 3 | 23.60 |
| High | 5320 | 24 | 18.517 | 23.68 | 3 | 23.68 |

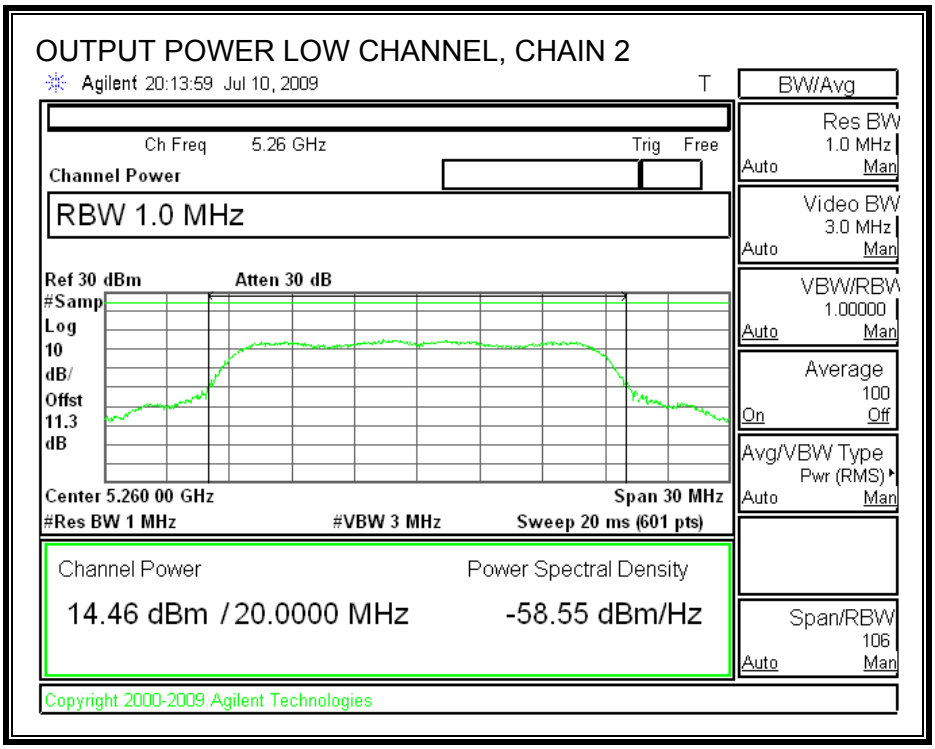
**Individual Chain Results**

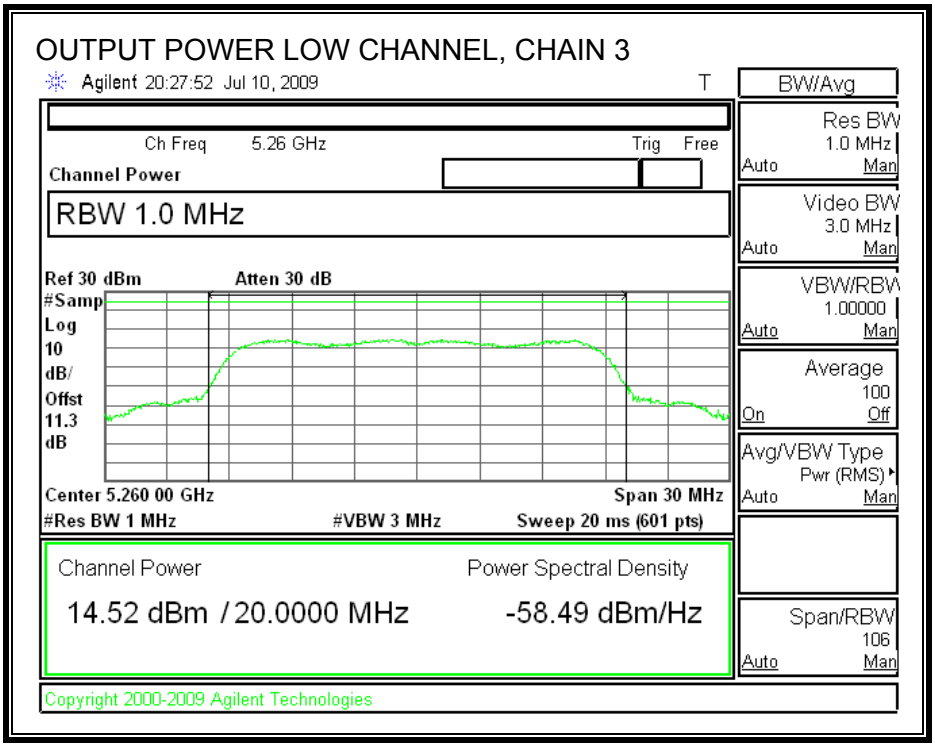
| Channel | Freq (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Chain 3 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| Low | 5260 | 14.45 | 14.59 | 14.46 | 14.52 | 20.53 | 23.68 | -3.15 |
| Mid | 5300 | 14.23 | 14.40 | 14.49 | 14.62 | 20.46 | 23.60 | -3.14 |
| High | 5320 | 14.67 | 14.59 | 14.69 | 14.57 | 20.65 | 23.68 | -3.02 |

**OUTPUT POWER, LOW CHANNEL**

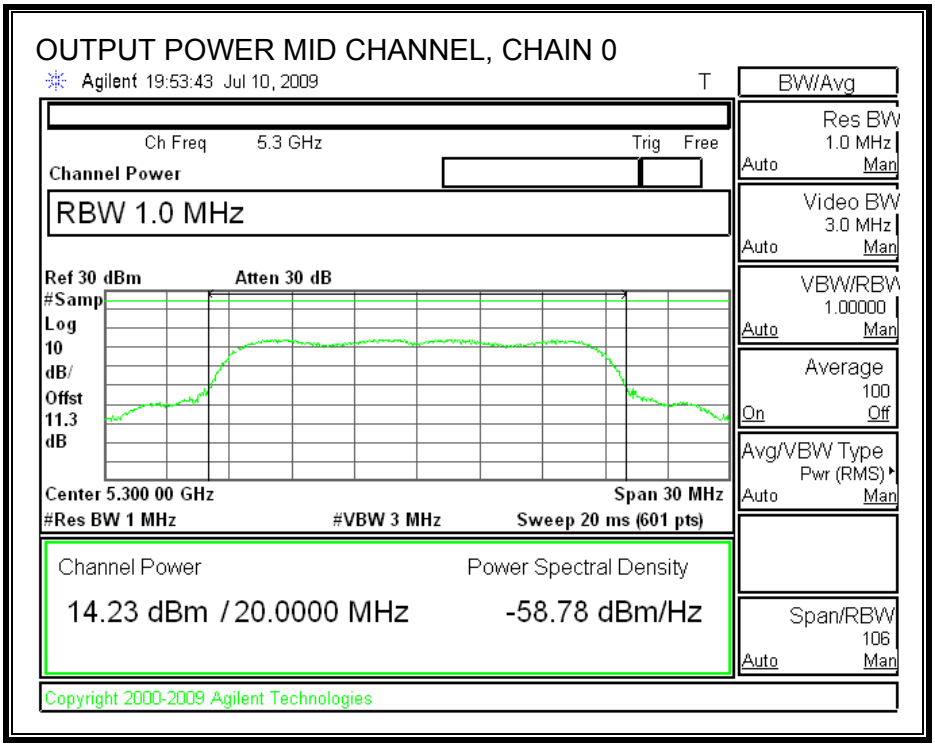


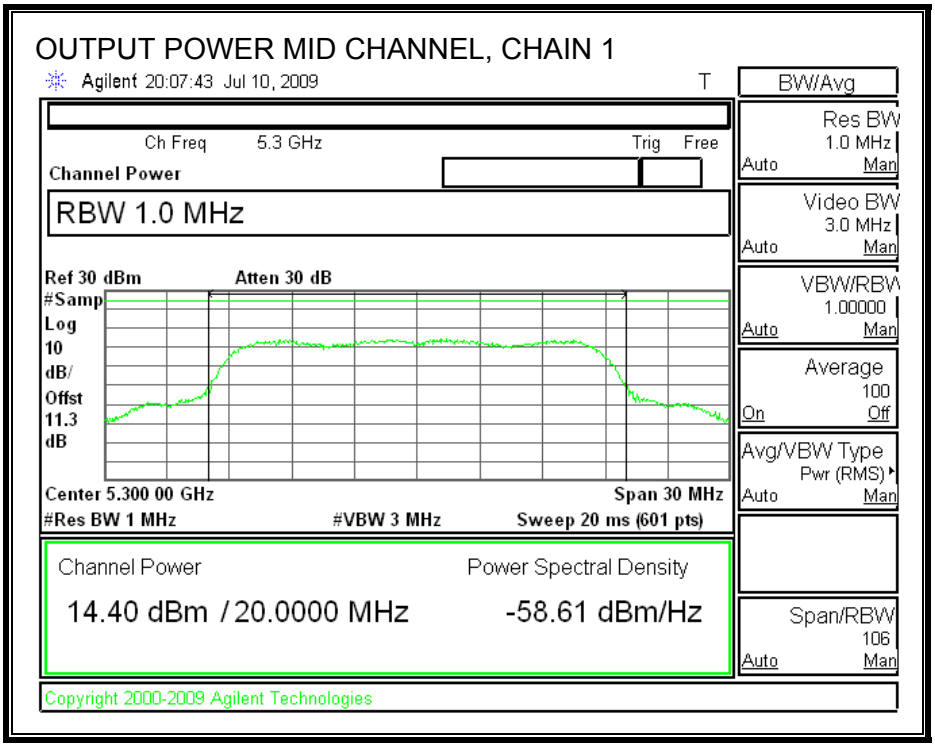





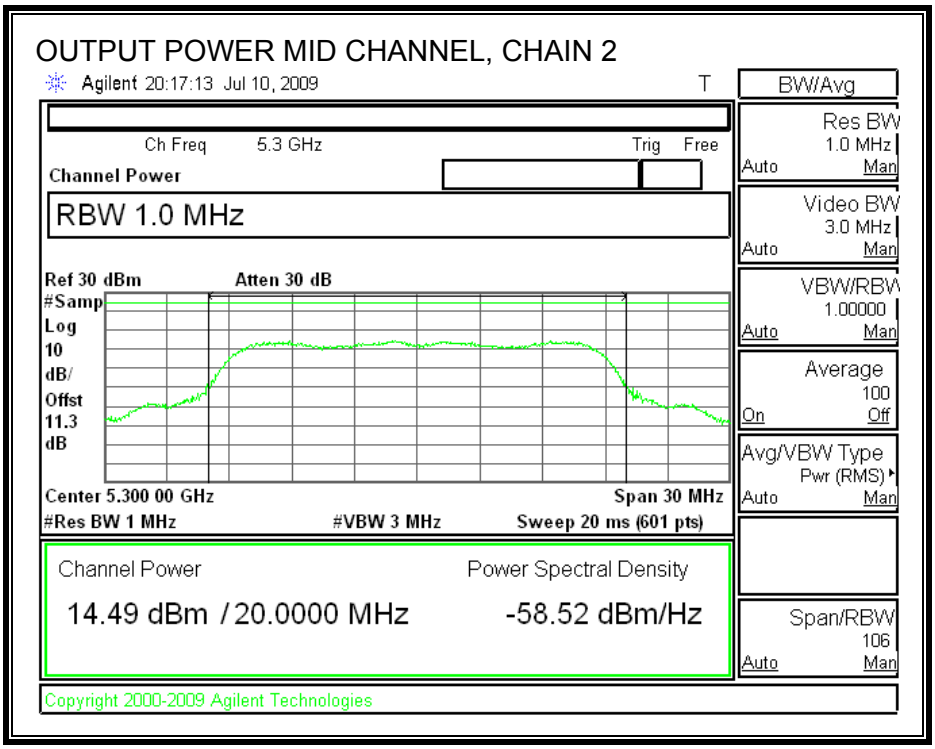



**OUTPUT POWER, MID CHANNEL**

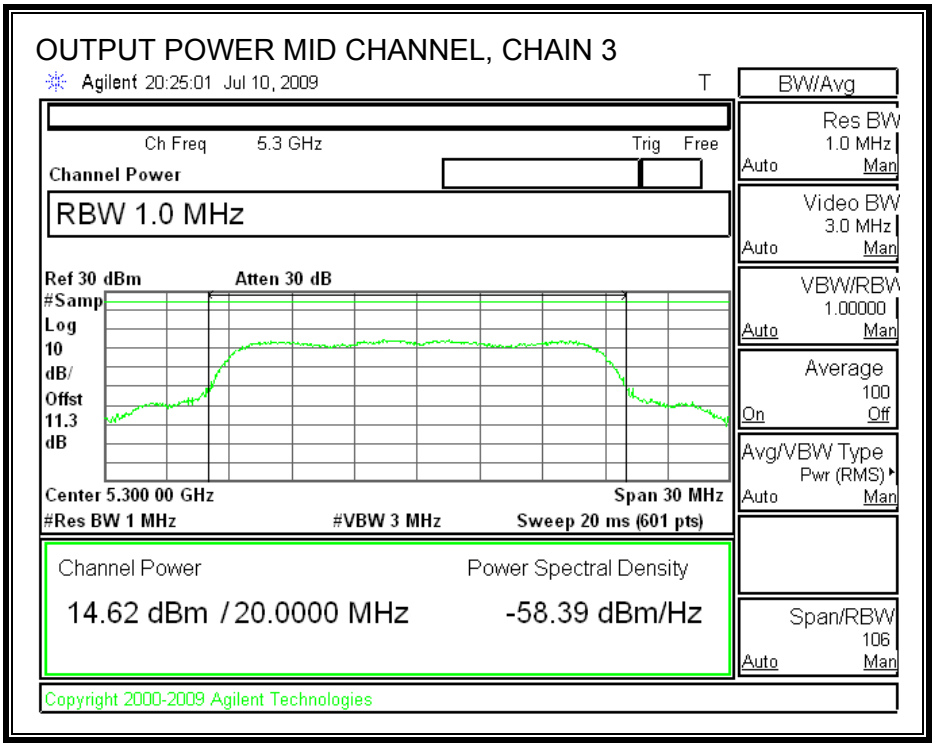


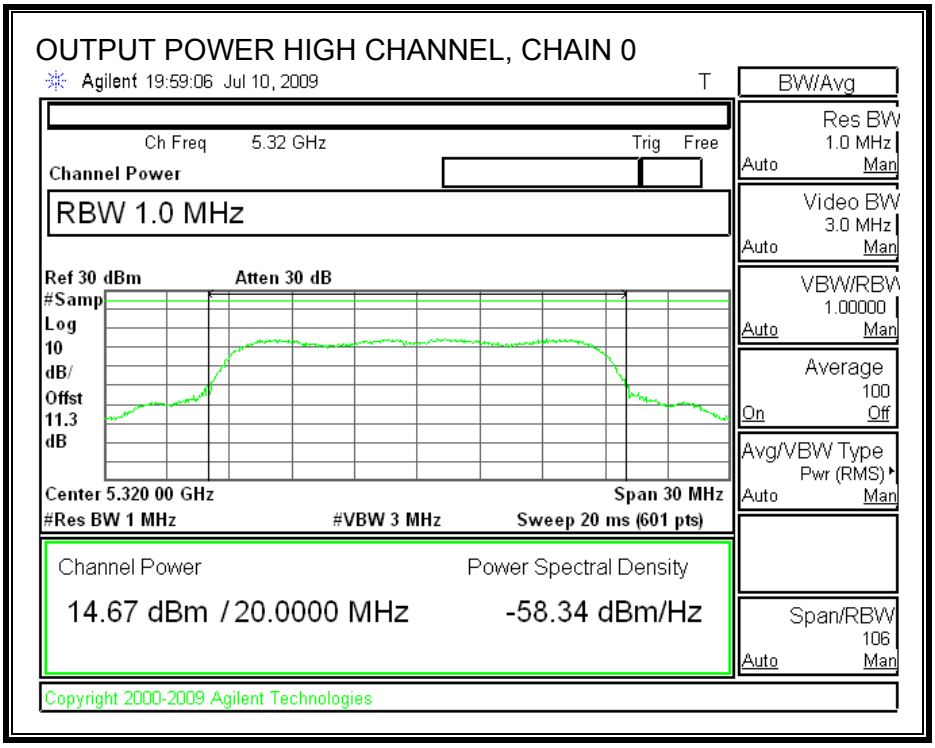
OUTPUT POWER MID CHANNEL, CHAIN 2

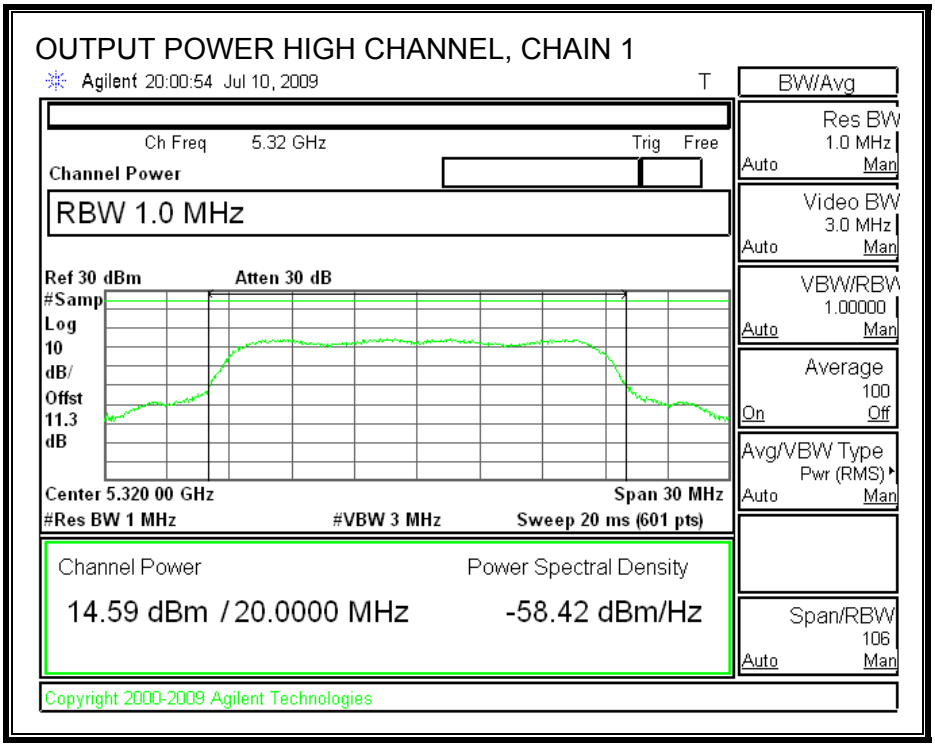



OUTPUT POWER MID CHANNEL, CHAIN 3

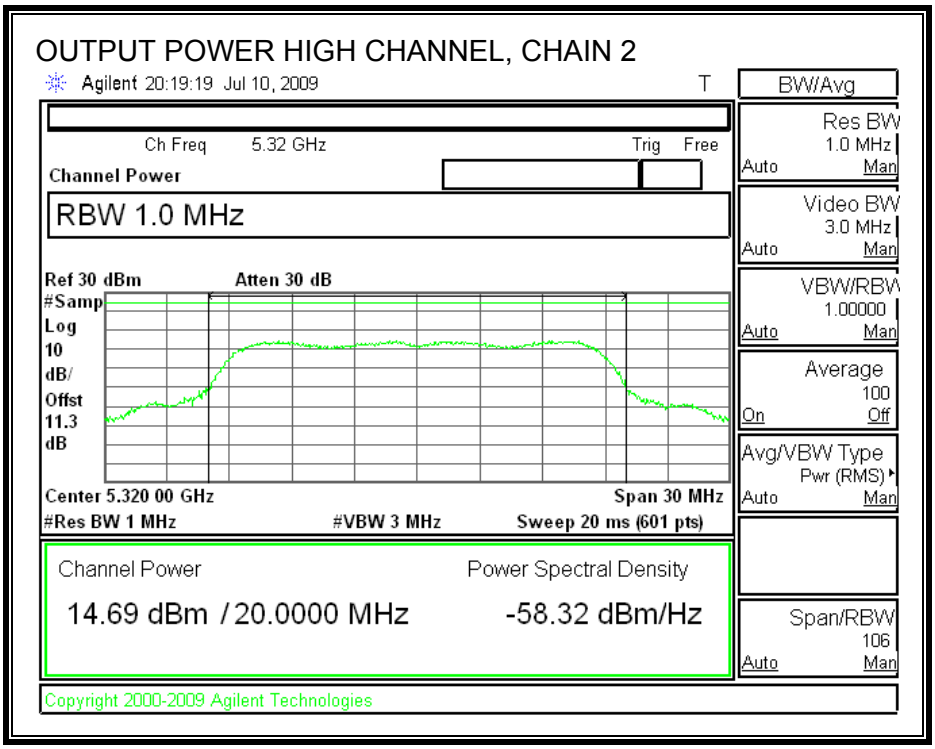


**OUTPUT POWER, HIGH CHANNEL**

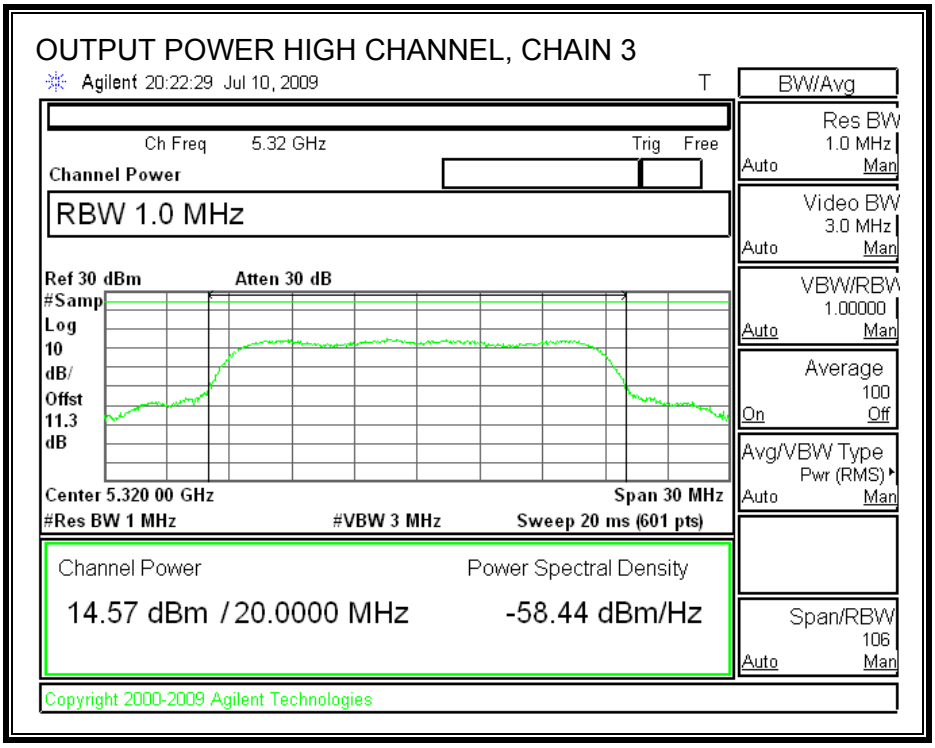


OUTPUT POWER HIGH CHANNEL, CHAIN 2




OUTPUT POWER HIGH CHANNEL, CHAIN 3



## 7.5.3. AVERAGE POWER

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.3 dB (including 10 dB pad and 1.3 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

**RESULTS**

| Frequency (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Chain 3 Power (dBm) |
|---|---|---|---|---|
| 5260 | 14.64 | 14.56 | 14.45 | 14.74 |
| 5300 | 14.44 | 14.53 | 14.51 | 14.64 |
| 5320 | 14.50 | 14.54 | 14.65 | 14.66 |

## 7.5.4. PEAK POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.25-5.35 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is less than 6 dBi; therefore the limit is 11 dBm.

**TEST PROCEDURE**

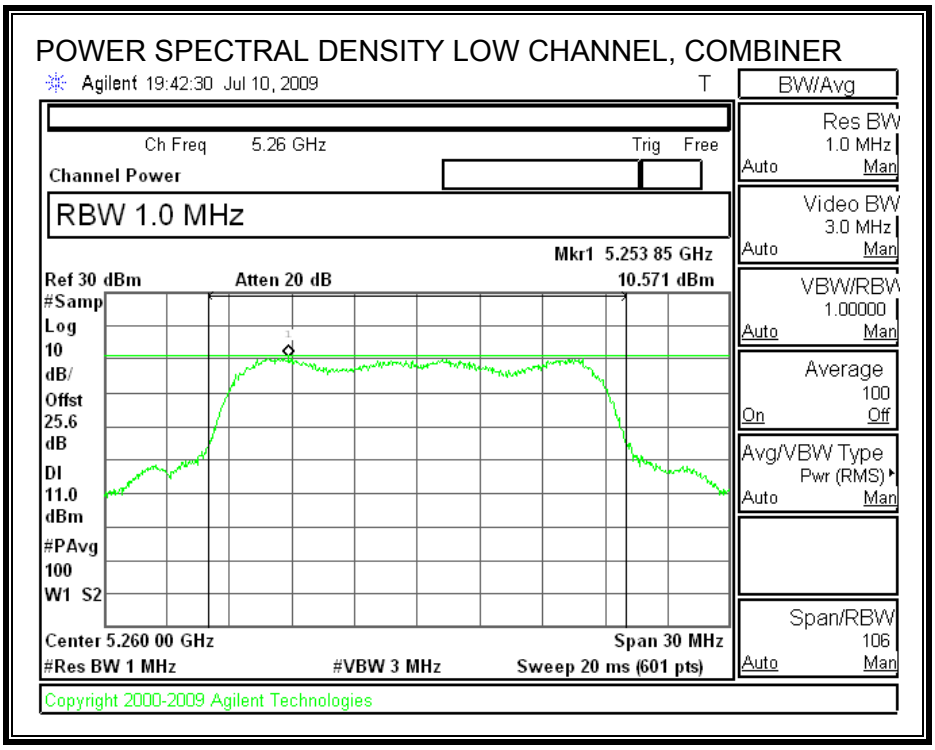
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

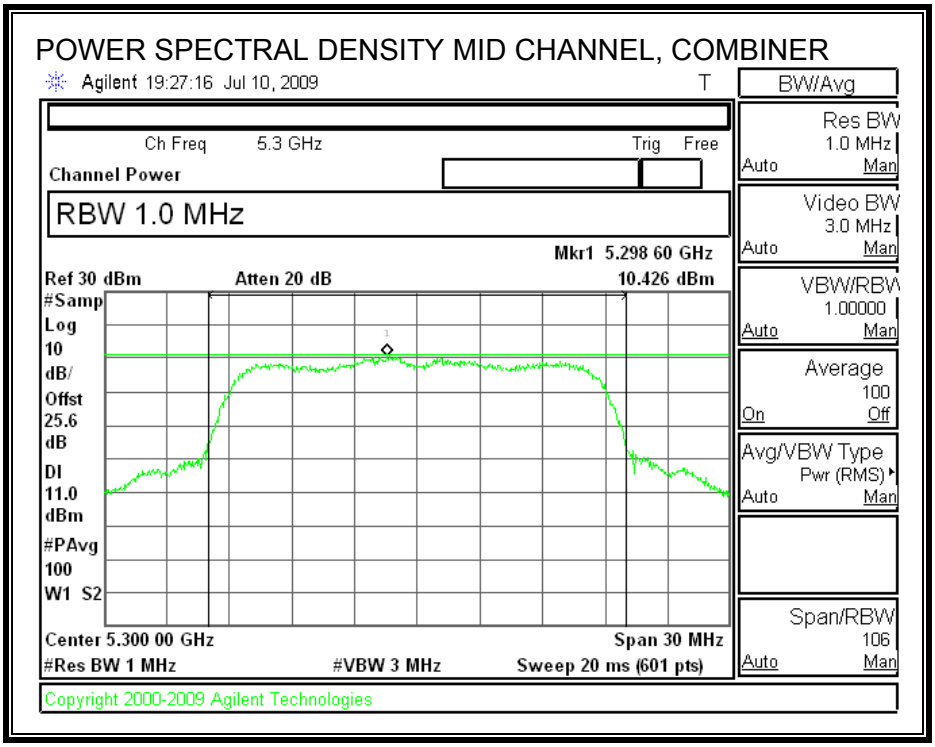
Preliminary tests on individual chains, and on all chains with a combiner, were performed. The worst-case configuration was with a combiner, therefore final test were performed with all chains feeding a combiner.

**RESULTS**

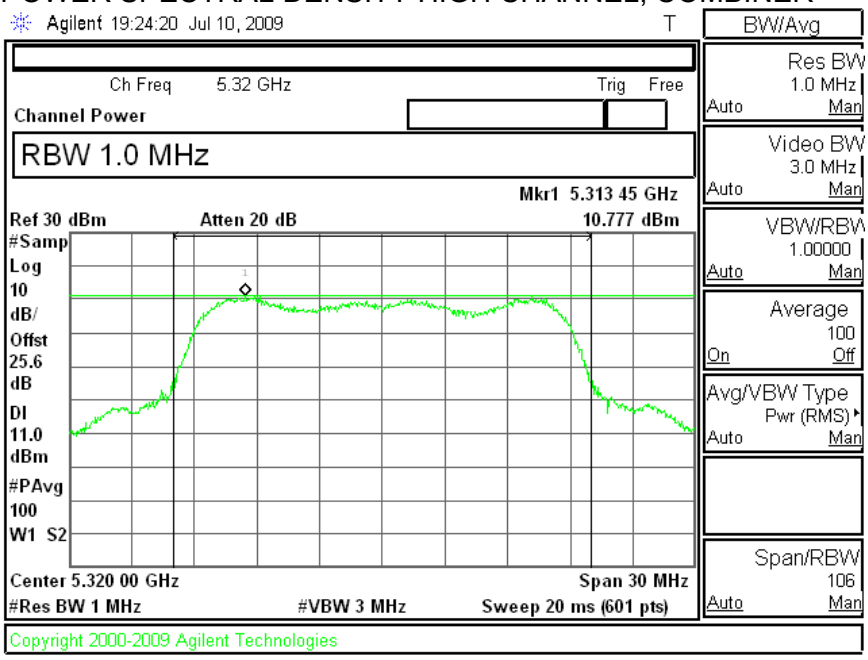
| Channel | Frequency (MHz) | PSD with Combiner (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 5260 | 10.57 | 11 | -0.43 |
| Middle | 5300 | 10.43 | 11 | -0.57 |
| High | 5320 | 10.78 | 11 | -0.22 |

**POWER SPECTRAL DENSITY**



POWER SPECTRAL DENSITY HIGH CHANNEL, COMBINER



## 7.5.5. PEAK EXCURSION

**LIMITS**

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

**TEST PROCEDURE**

The transmitter outputs are connected to the spectrum analyzer via a combiner.

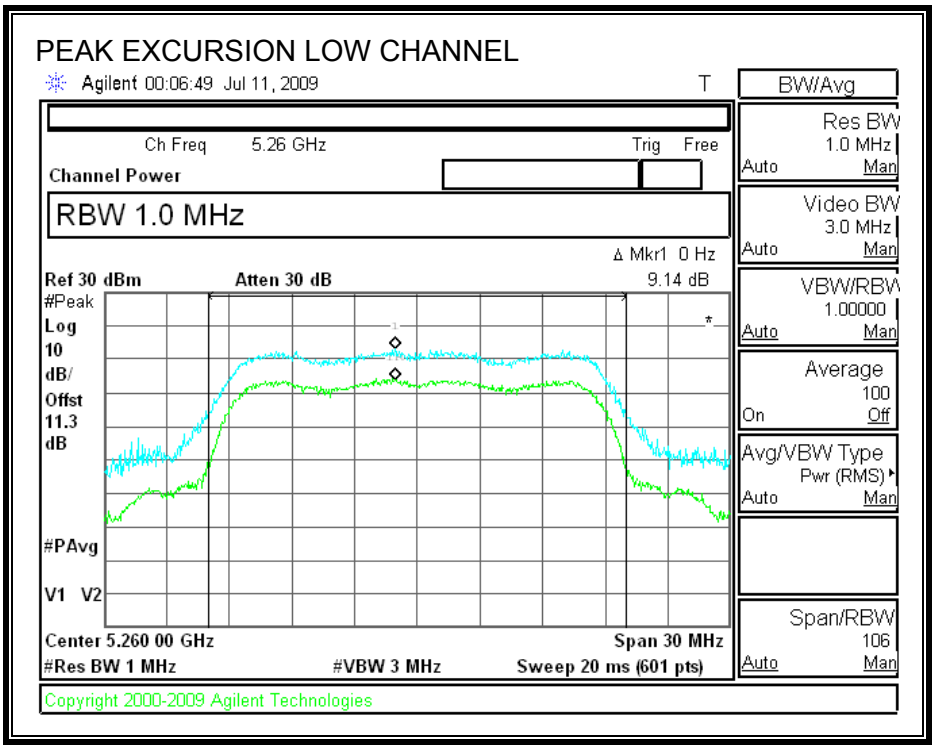
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

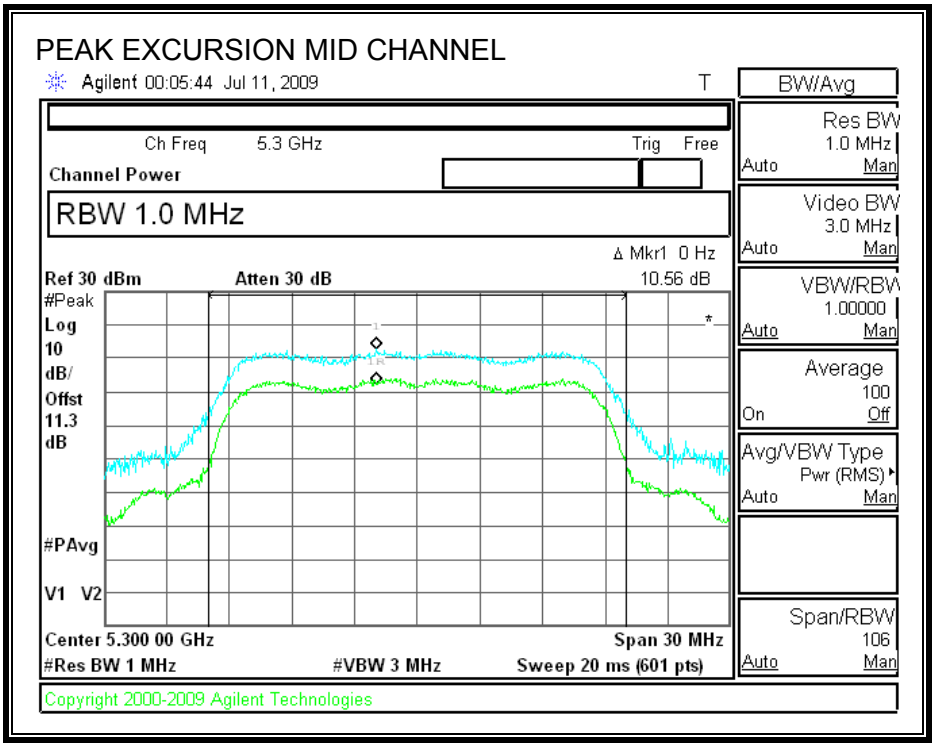
Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

**RESULTS**

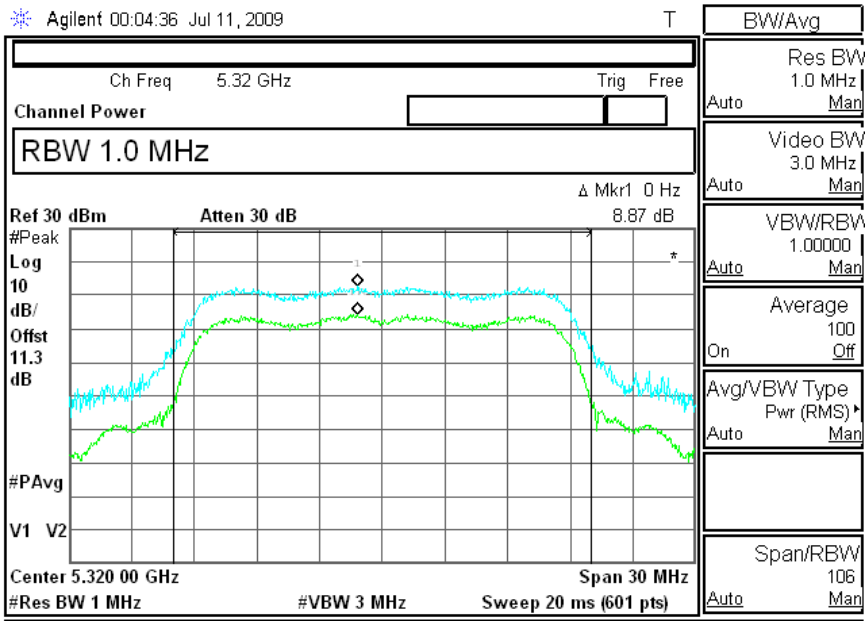
| Channel | Frequency (MHz) | Peak Excursion (dB) | Limit (dB) | Margin (dB) |
|---|---|---|---|---|
| Low | 5260 | 9.14 | 13 | -3.86 |
| Middle | 5300 | 10.56 | 13 | -2.44 |
| High | 5320 | 8.87 | 13 | -4.13 |

**PEAK EXCURSION**



PEAK EXCURSION HIGH CHANNEL



## 7.5.6. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.407 (b) (3)

IC RSS-210 A9.3 (3)

For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.25-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

**TEST PROCEDURE**

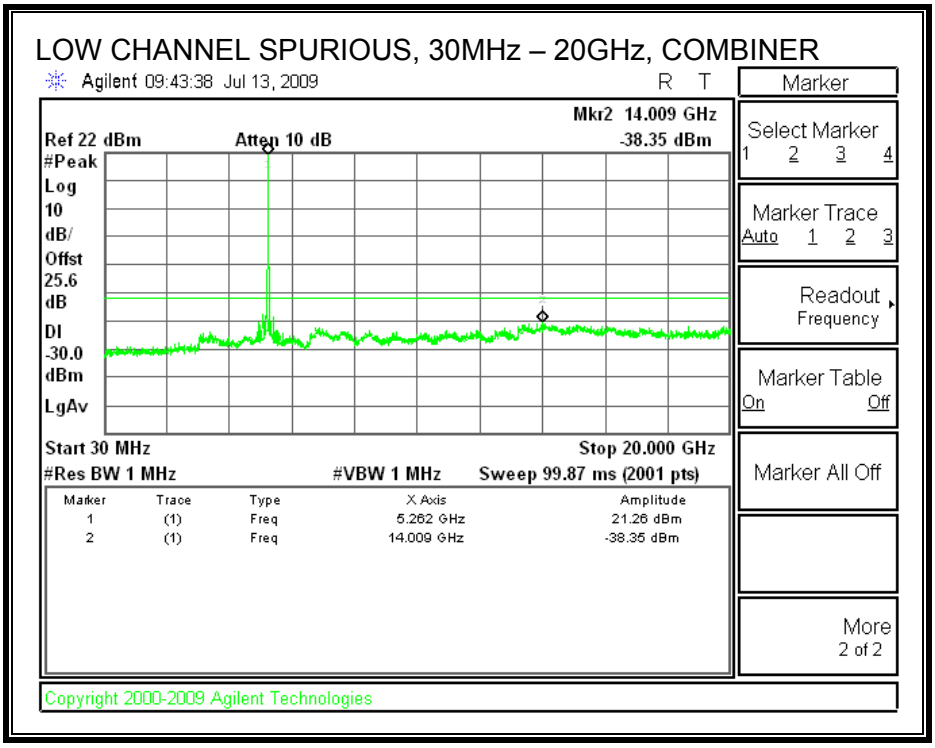
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

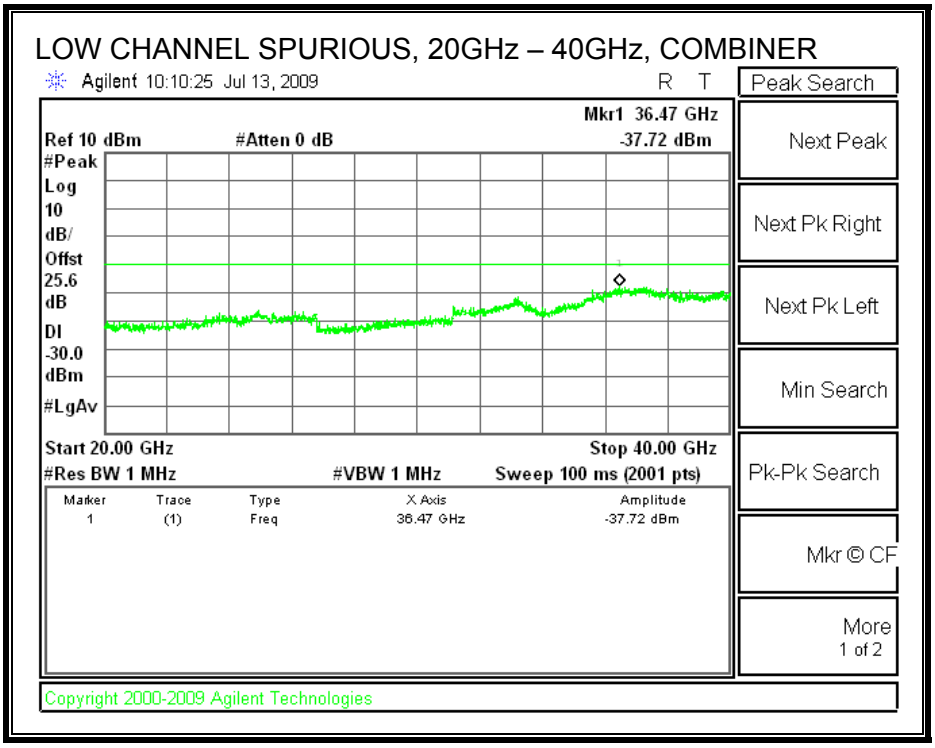
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

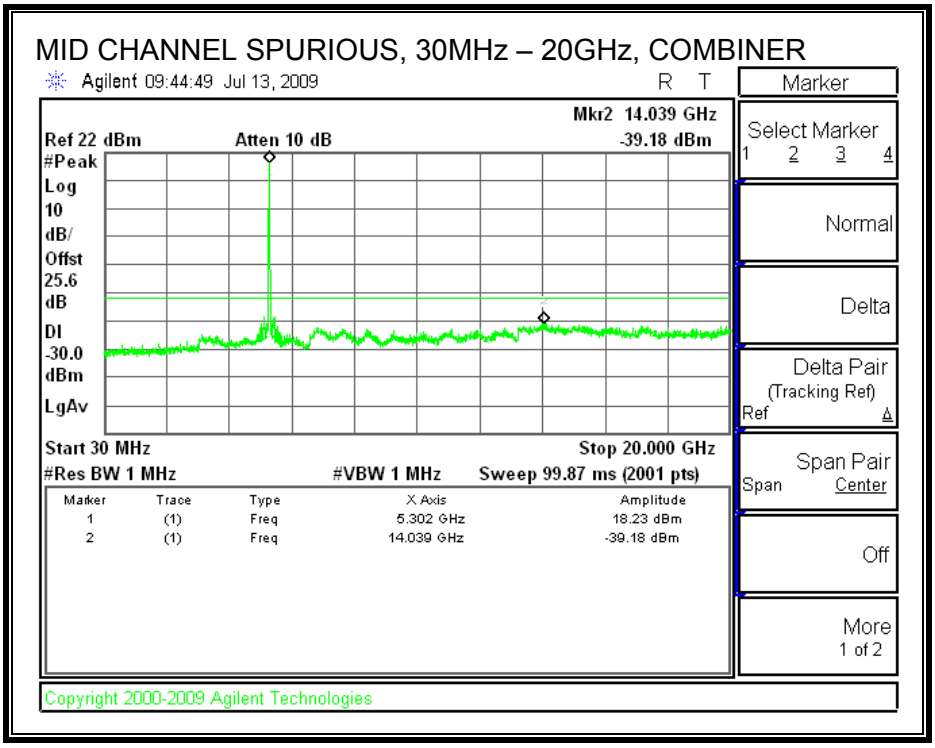
Preliminary tests on individual chains, and on all chains with a combiner, were performed. The worst-case configuration was with a combiner, therefore final test were performed with all chains feeding a combiner.

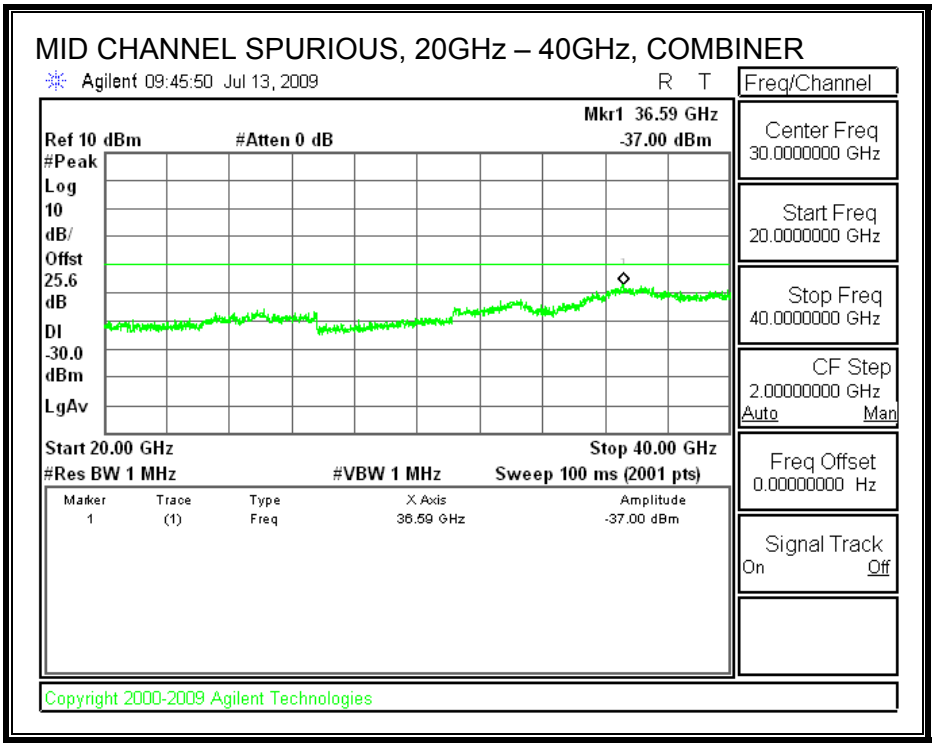
**LOW CHANNEL SPURIOUS EMISSIONS**



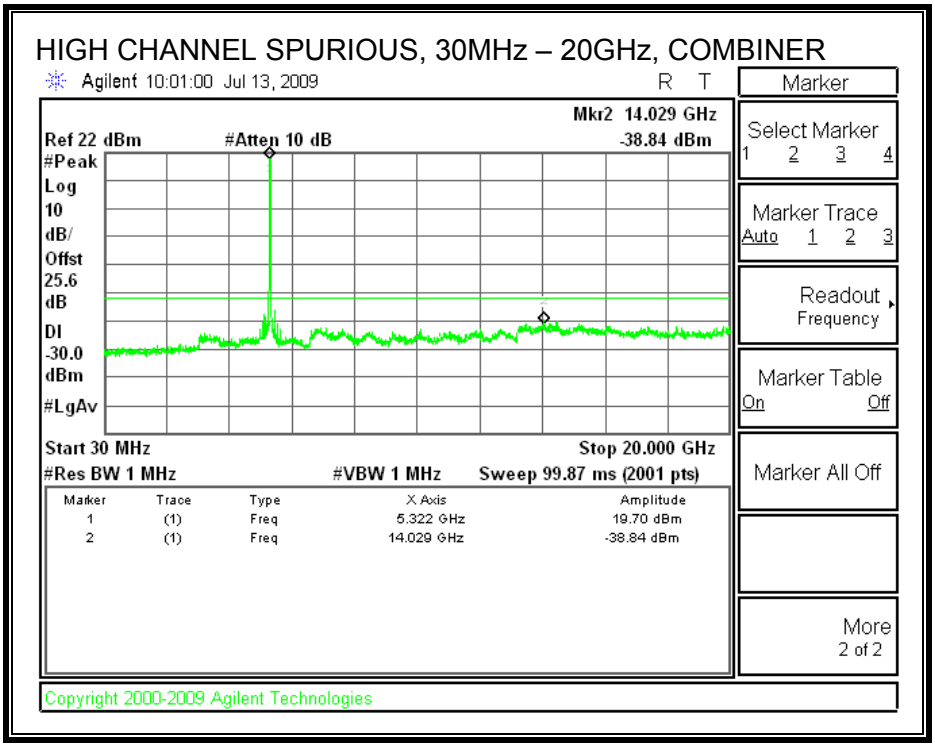



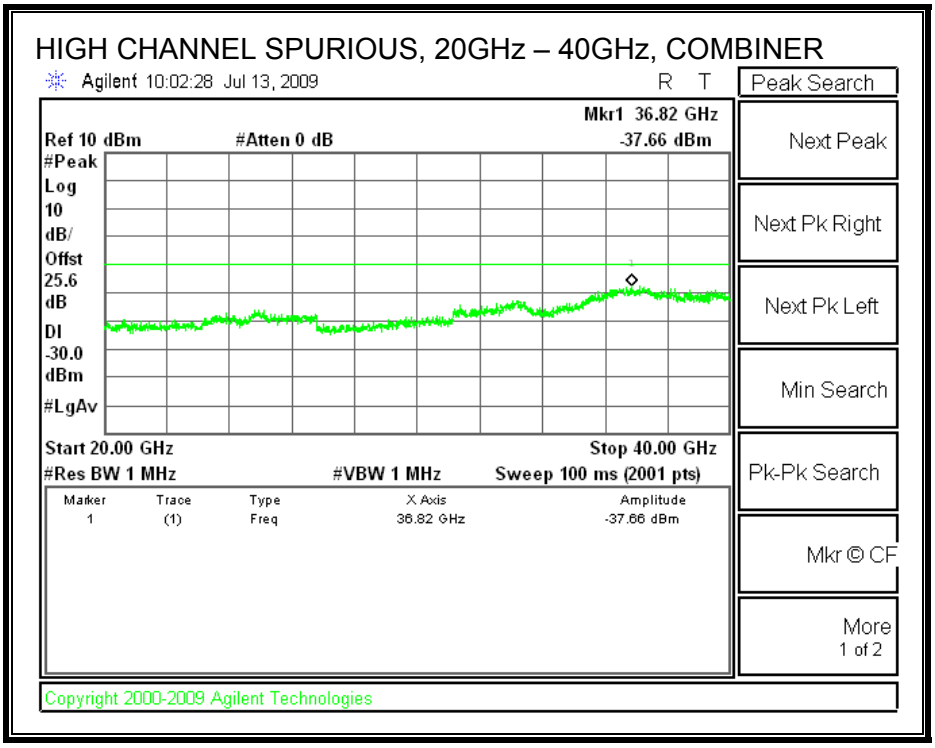
**MID CHANNEL SPURIOUS EMISSIONS**



**HIGH CHANNEL SPURIOUS EMISSIONS**



# 7.6. 5.3 GHz BAND CHANNEL TESTS FOR 802.11n HT40 MODE

## 7.6.1. 99% & 26 dB BANDWIDTH

**LIMITS**

None; for reporting purposes only.

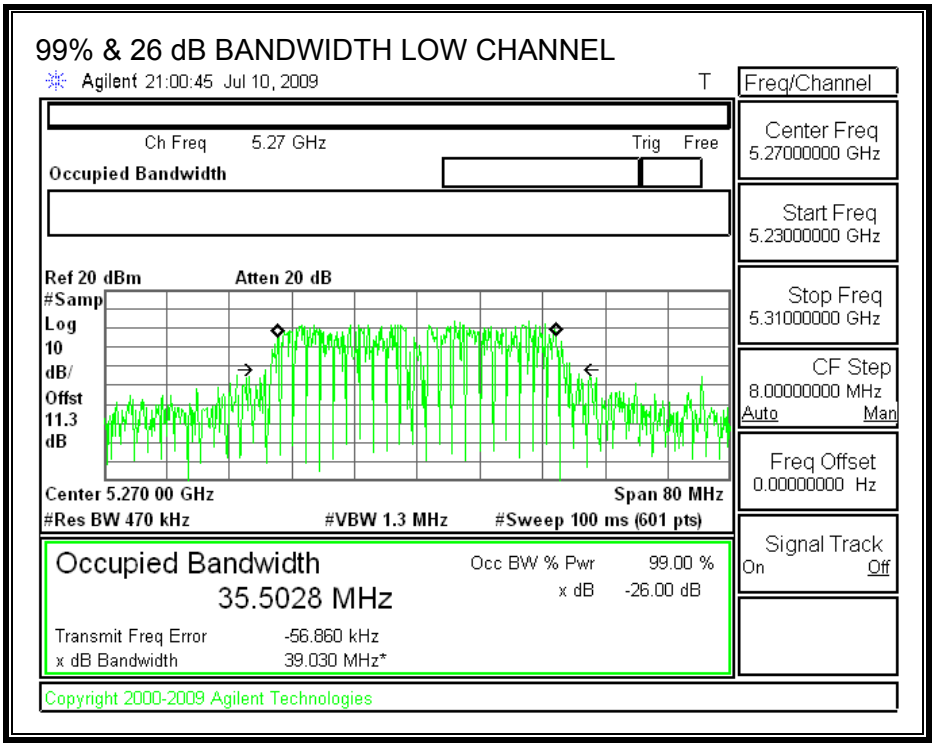
**TEST PROCEDURE**

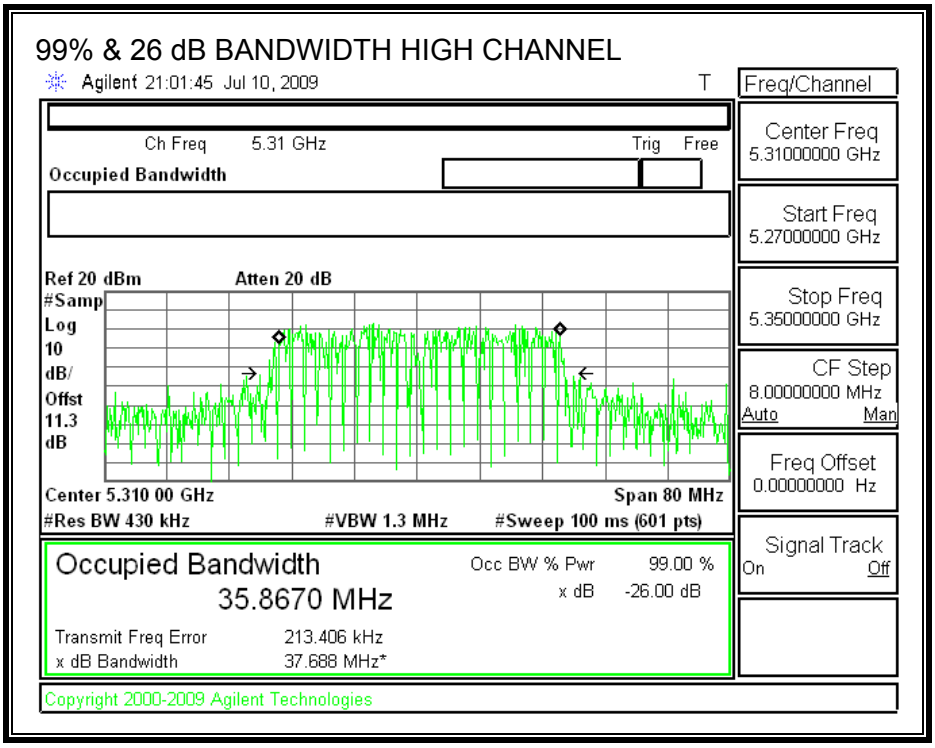
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth measurement function is utilized.

**RESULTS**

| Channel | Frequency (MHz) | 99% OBW (MHz) | 26 dB BW (MHz) |
|---|---|---|---|
| Low | 5270 | 35.503 | 39.030 |
| High | 5310 | 35.867 | 37.688 |

**99% & 26 dB BANDWIDTH**



## 7.6.2. OUTPUT POWER

**LIMITS**

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.25-5.35 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**TEST PROCEDURE**

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

**RESULTS**

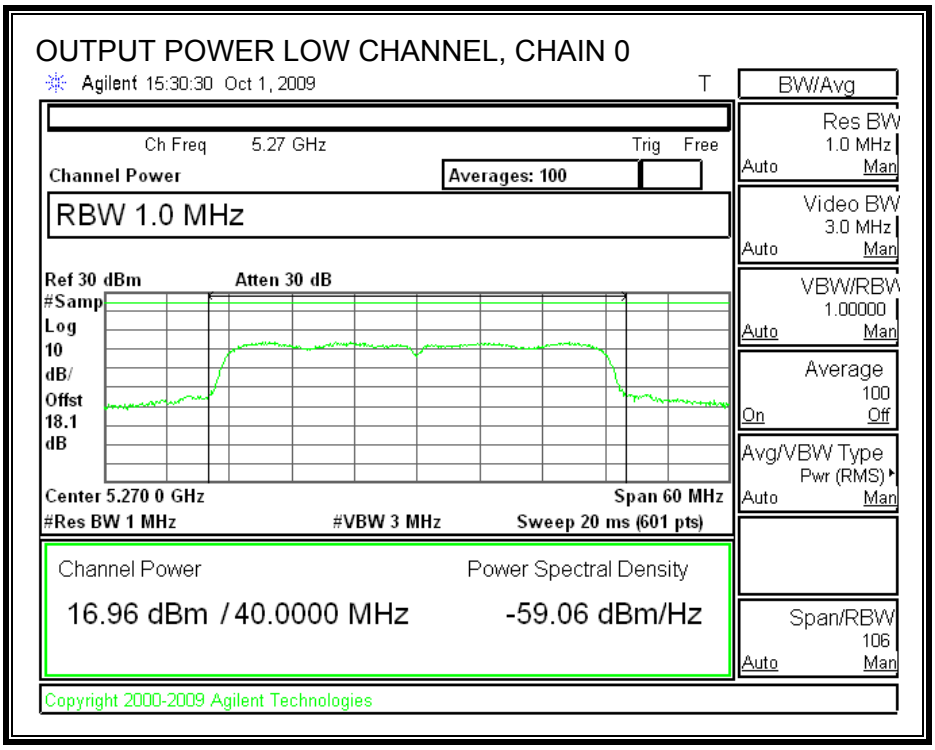
**Limit**

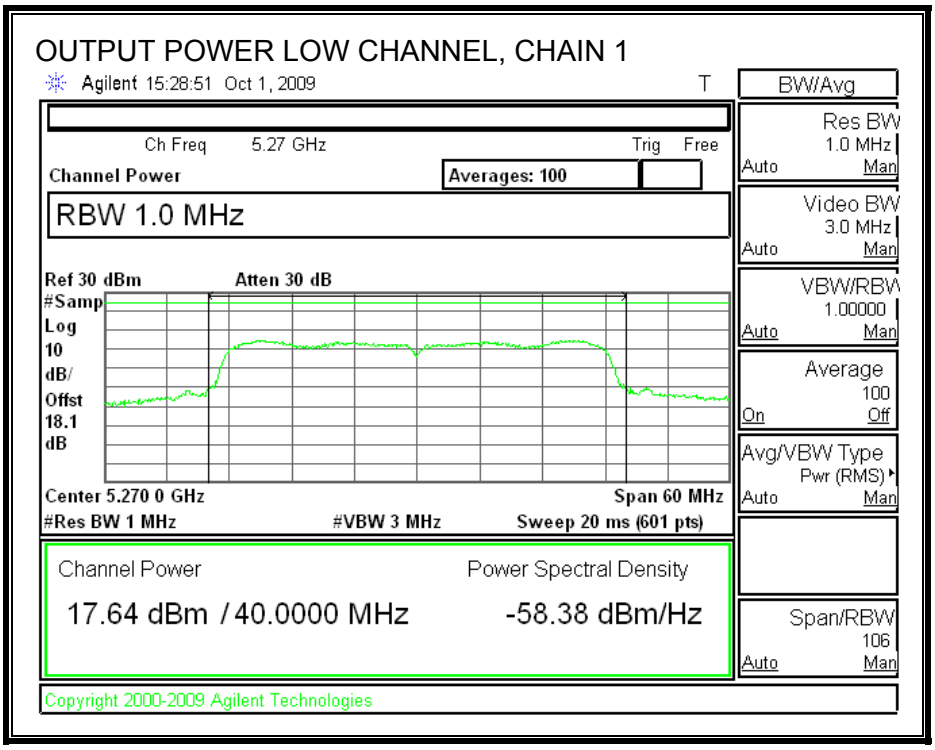
| Channel | Freq (MHz) | Fixed Limit (dBm) | B (MHz) | 11 + 10 Log B Limit (dBm) | Antenna Gain (dBi) | Limit (dBm) |
|---|---|---|---|---|---|---|
| Low | 5270 | 24 | 39.03 | 26.91 | 3 | 24.00 |
| High | 5310 | 24 | 37.688 | 26.76 | 3 | 24.00 |

**Individual Chain Results**

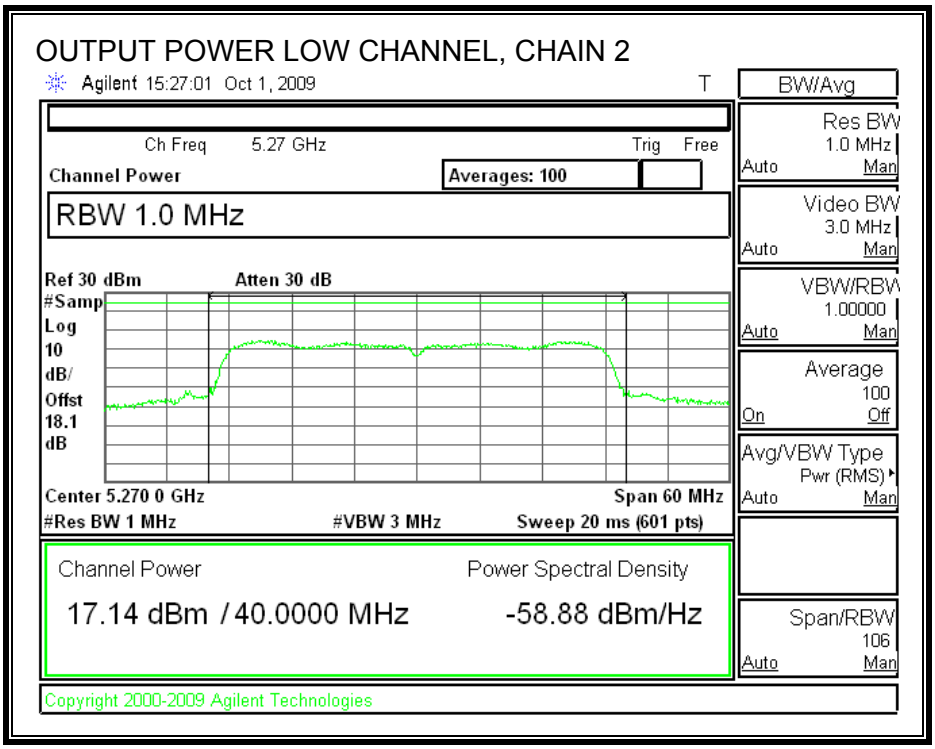
| Channel | Freq (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Chain 3 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| Low | 5270 | 16.96 | 17.64 | 17.14 | 17.12 | 23.24 | 24.00 | -0.76 |
| High | 5310 | 12.14 | 12.46 | 11.86 | 12.15 | 18.18 | 24.00 | -5.82 |

**OUTPUT POWER, LOW CHANNEL**

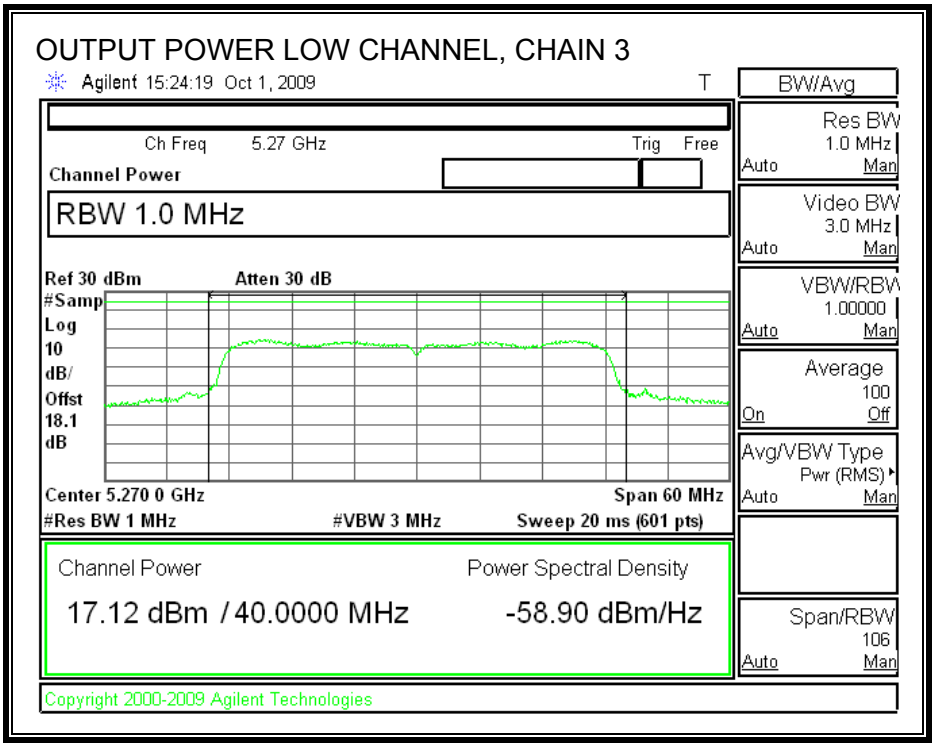


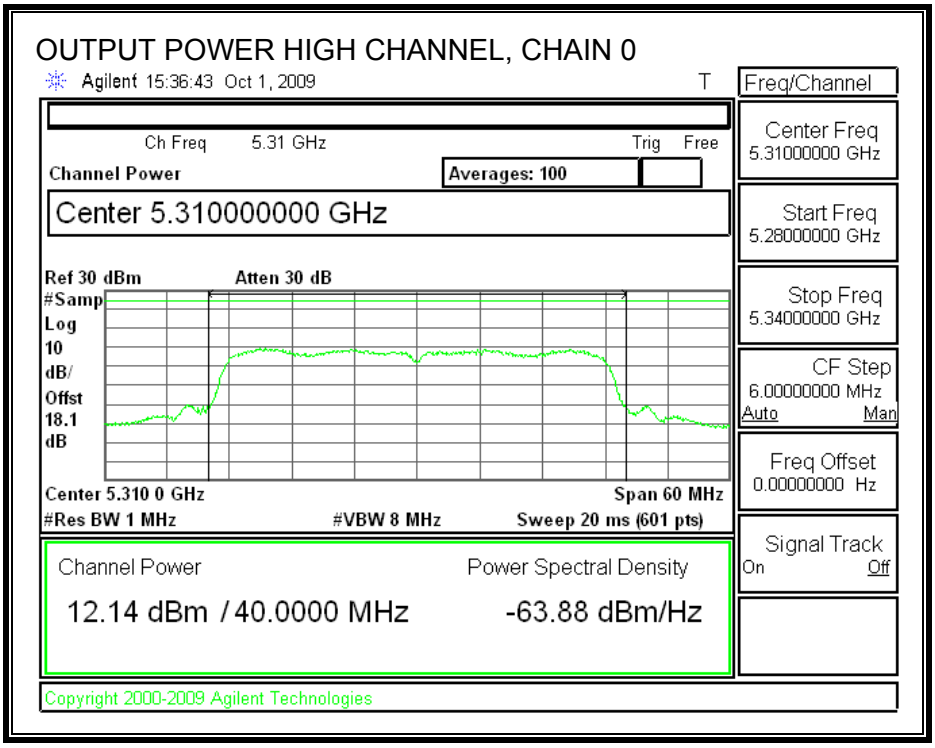
OUTPUT POWER LOW CHANNEL, CHAIN 2

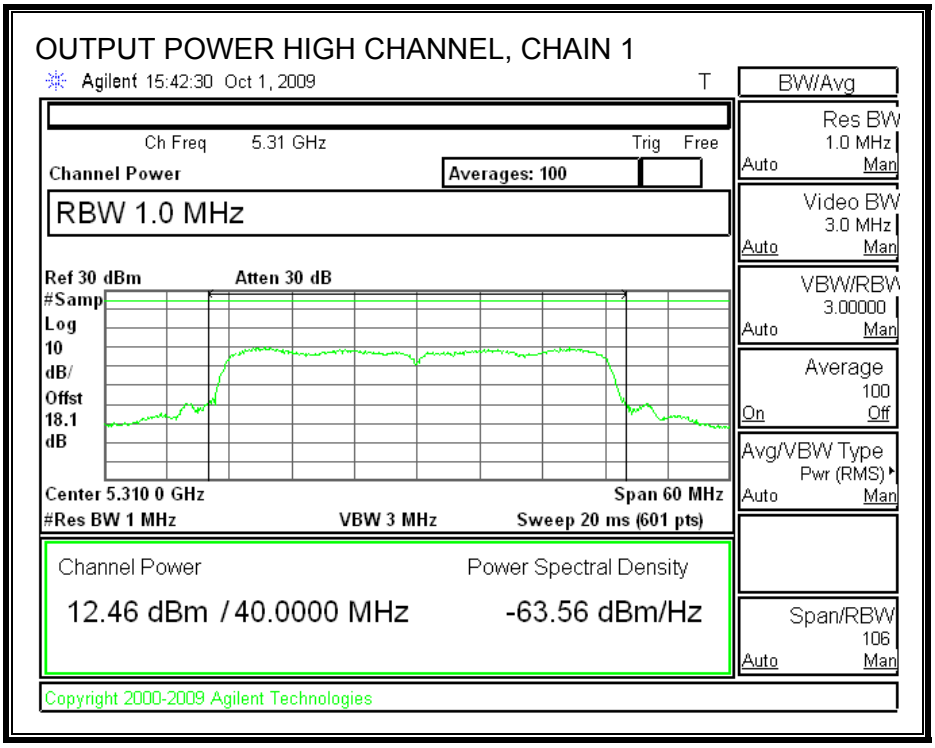



OUTPUT POWER LOW CHANNEL, CHAIN 3

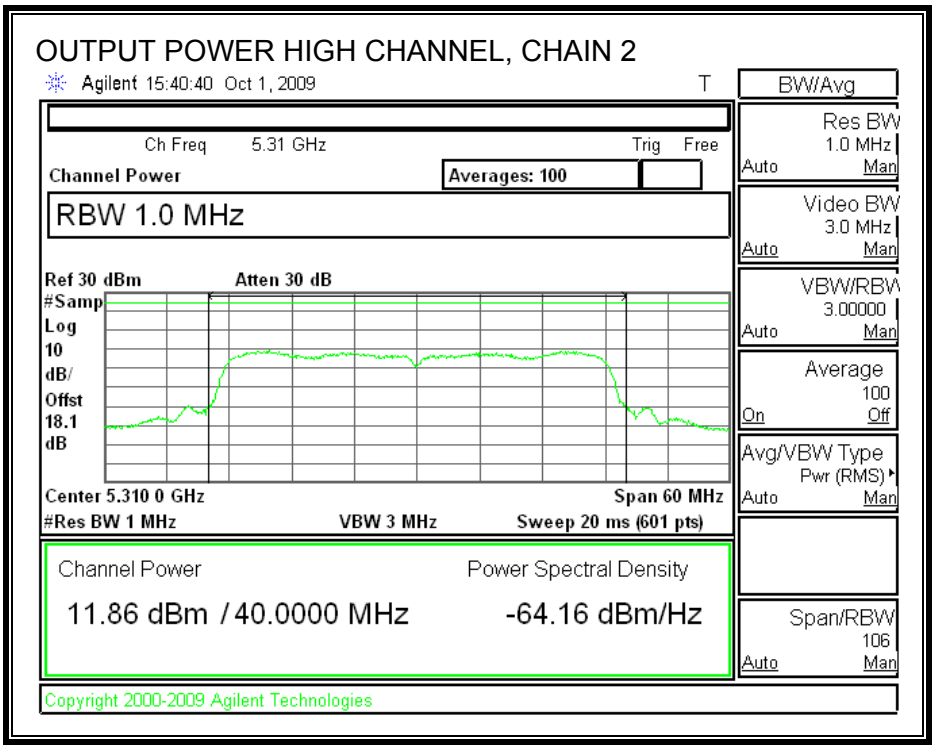


**OUTPUT POWER, HIGH CHANNEL**

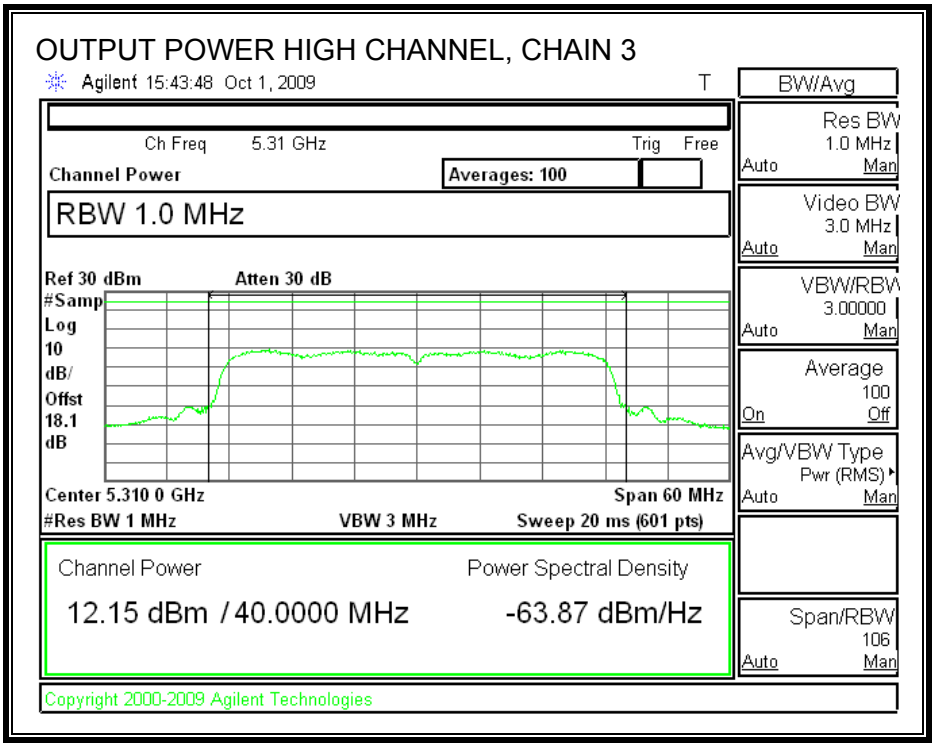


OUTPUT POWER HIGH CHANNEL, CHAIN 2




OUTPUT POWER HIGH CHANNEL, CHAIN 3



## 7.6.3. AVERAGE POWER

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.3 dB (including 10 dB pad and 1.3 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

**RESULTS**

| Channel | Frequency (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Chain 3 Power (dBm) |
|---|---|---|---|---|---|
| Low | 5270 | 16.88 | 17.59 | 17.09 | 17.12 |
| High | 5310 | 12.10 | 12.38 | 11.78 | 12.09 |

## 7.6.4. PEAK POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.25–5.35 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is less than 6 dBi, therefore the limit is 11 dBm.

**TEST PROCEDURE**

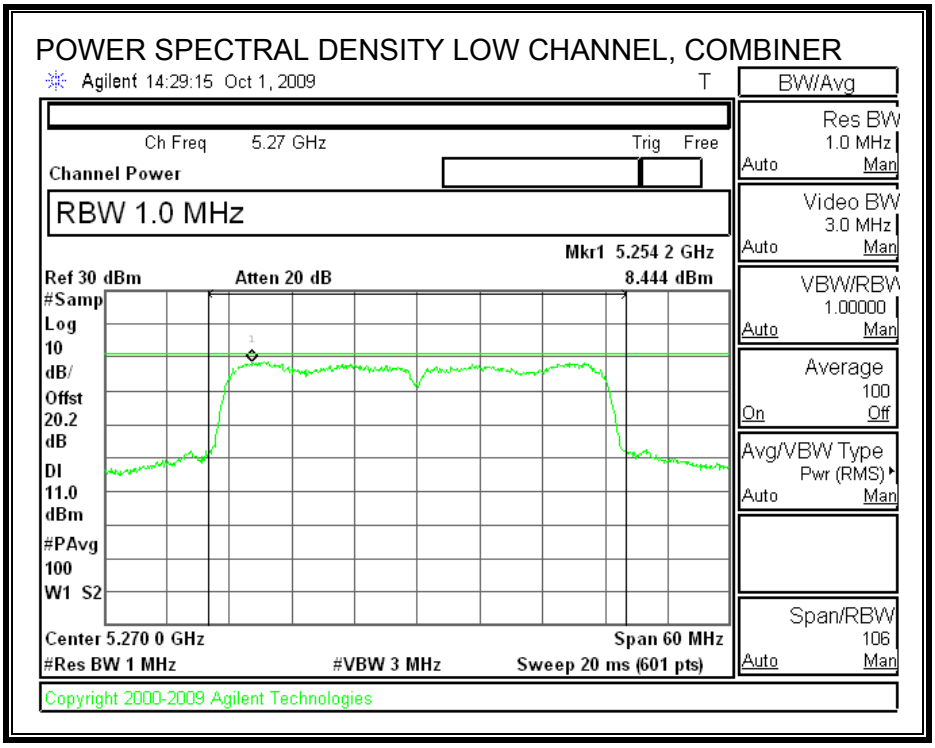
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

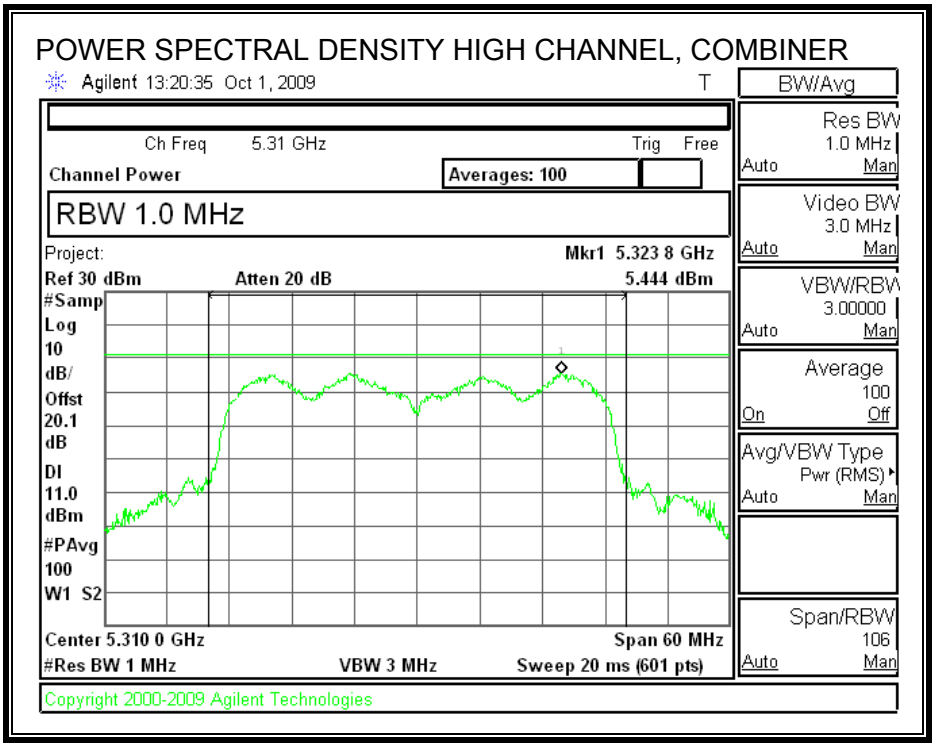
Preliminary tests on individual chains, and on all chains with a combiner, were performed. The worst-case configuration was with a combiner, therefore final test were performed with all chains feeding a combiner.

**RESULTS**

| Channel | Frequency (MHz) | PSD with Combiner (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 5270 | 8.444 | 11 | -2.56 |
| High | 5310 | 5.444 | 11 | -5.56 |

**POWER SPECTRAL DENSITY**



## 7.6.5. PEAK EXCURSION

**LIMITS**

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

**TEST PROCEDURE**

The transmitter outputs are connected to the spectrum analyzer via a combiner.

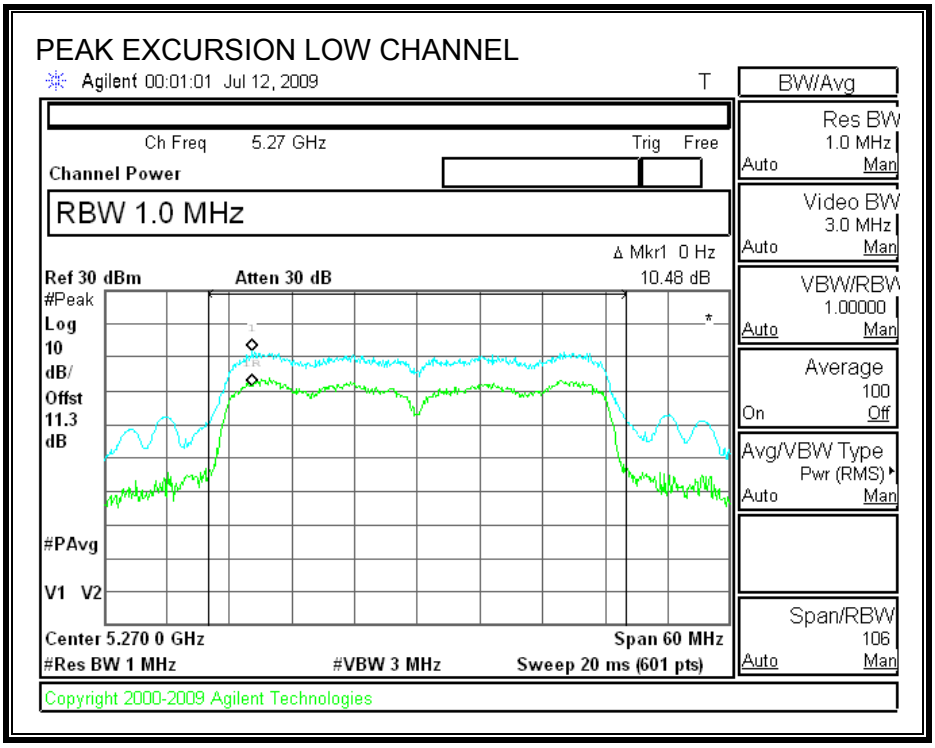
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

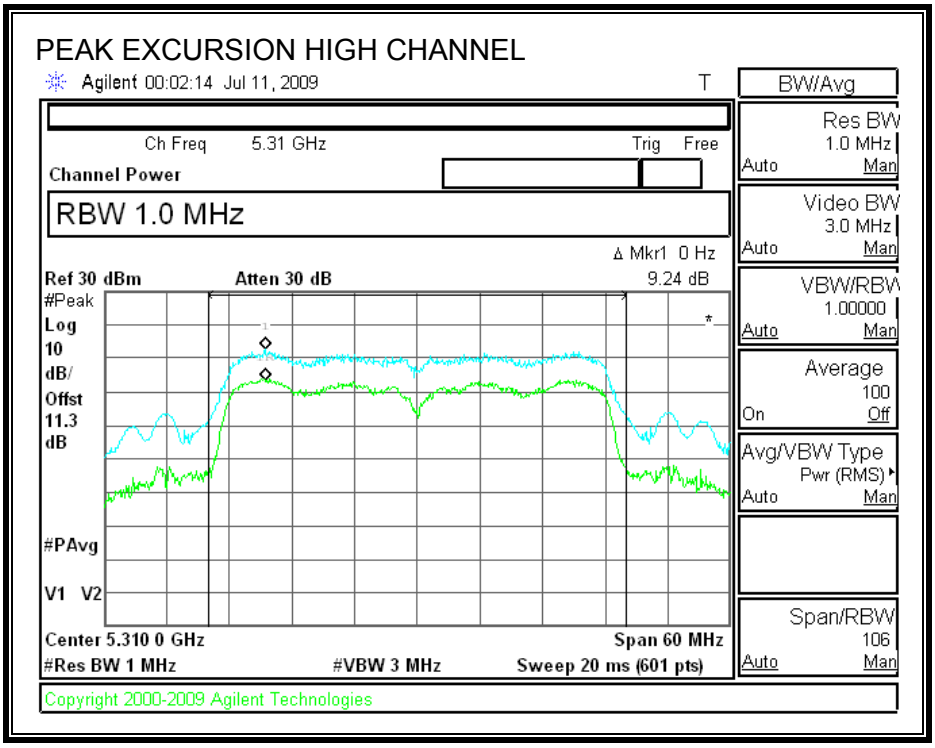
Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

**RESULTS**

| Channel | Frequency (MHz) | Peak Excursion (dB) | Limit (dB) | Margin (dB) |
|---|---|---|---|---|
| Low | 5270 | 10.48 | 13 | -2.52 |
| High | 5310 | 9.24 | 13 | -3.76 |

**PEAK EXCURSION**



## 7.6.6. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.407 (b) (3)

IC RSS-210 A9.3 (3)

For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.25-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

**TEST PROCEDURE**

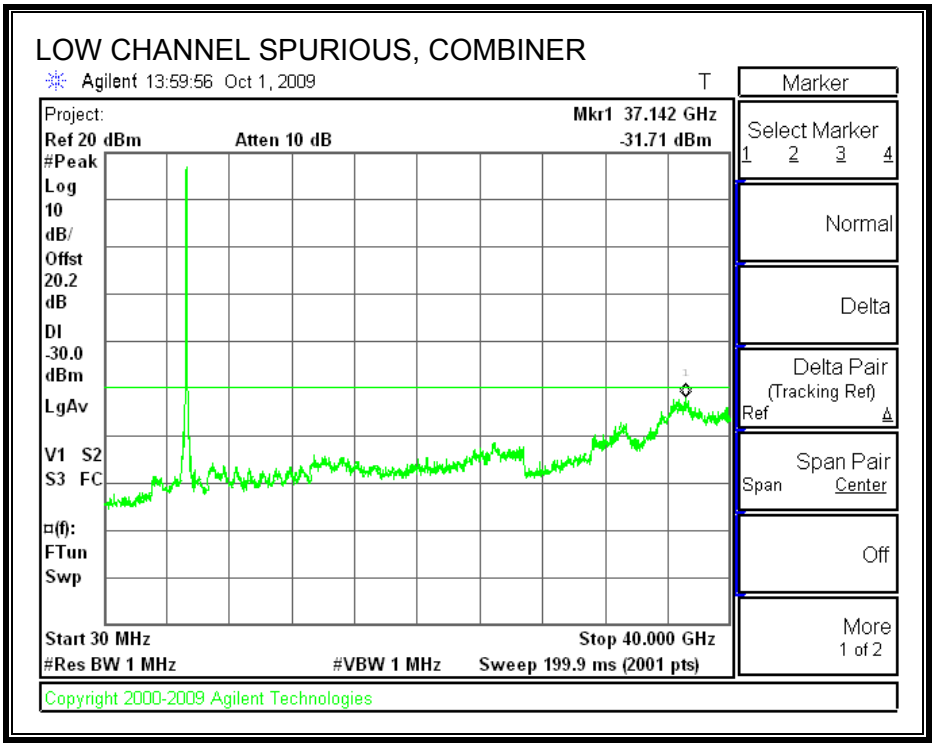
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

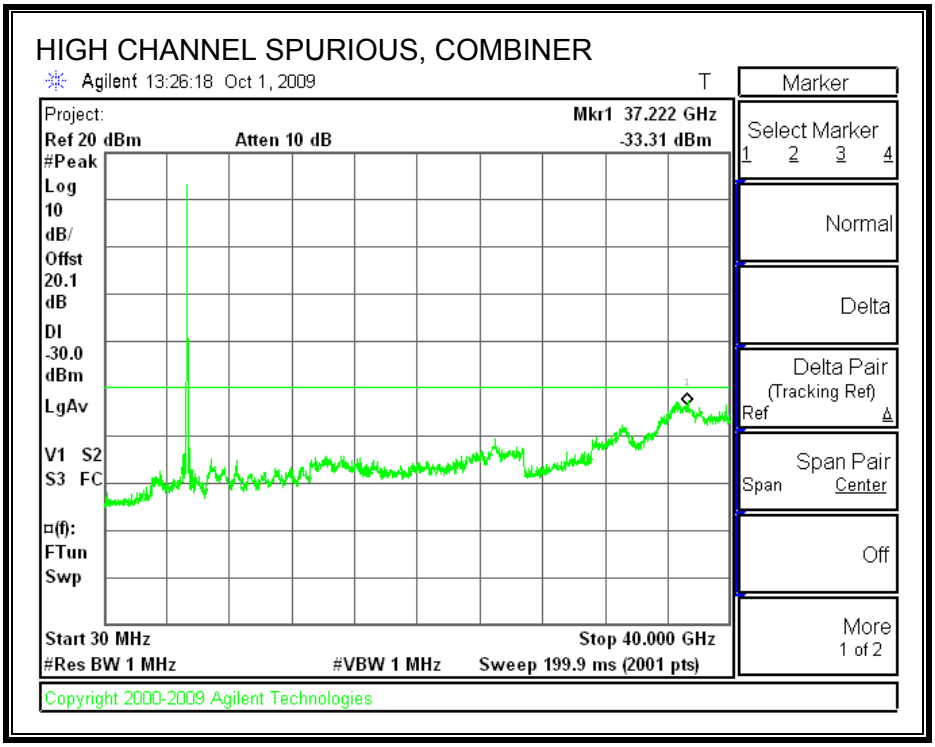
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

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

**LOW CHANNEL SPURIOUS EMISSIONS**



**HIGH CHANNEL SPURIOUS EMISSIONS**



# 7.7. 5.6 GHz BAND CHANNEL TESTS FOR 802.11a MODE

## 7.7.1. 26 dB and 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

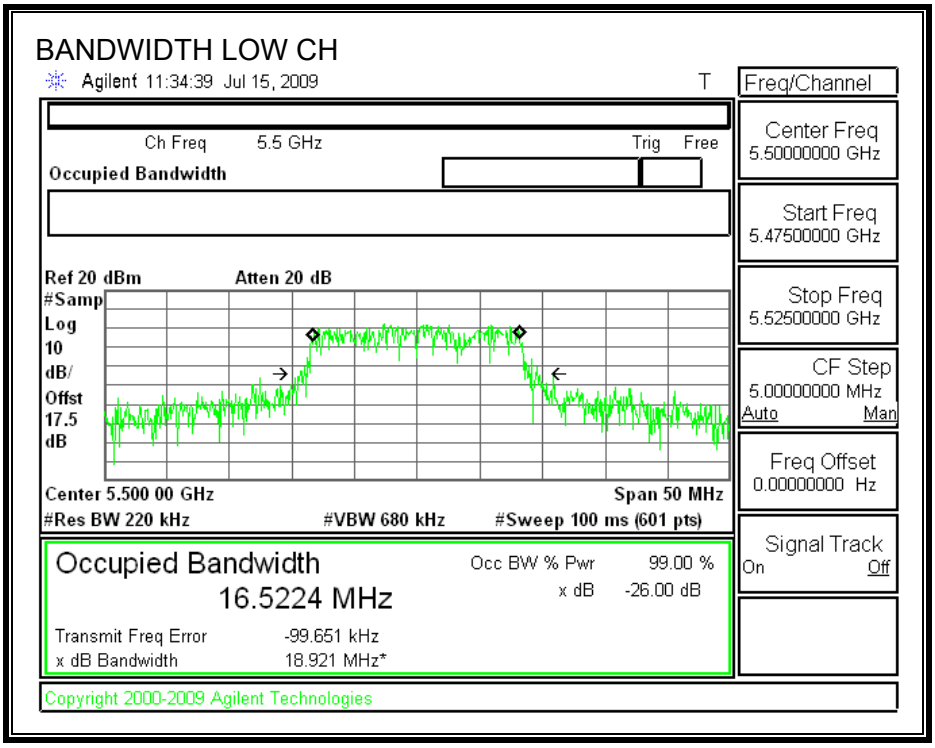
**TEST PROCEDURE**

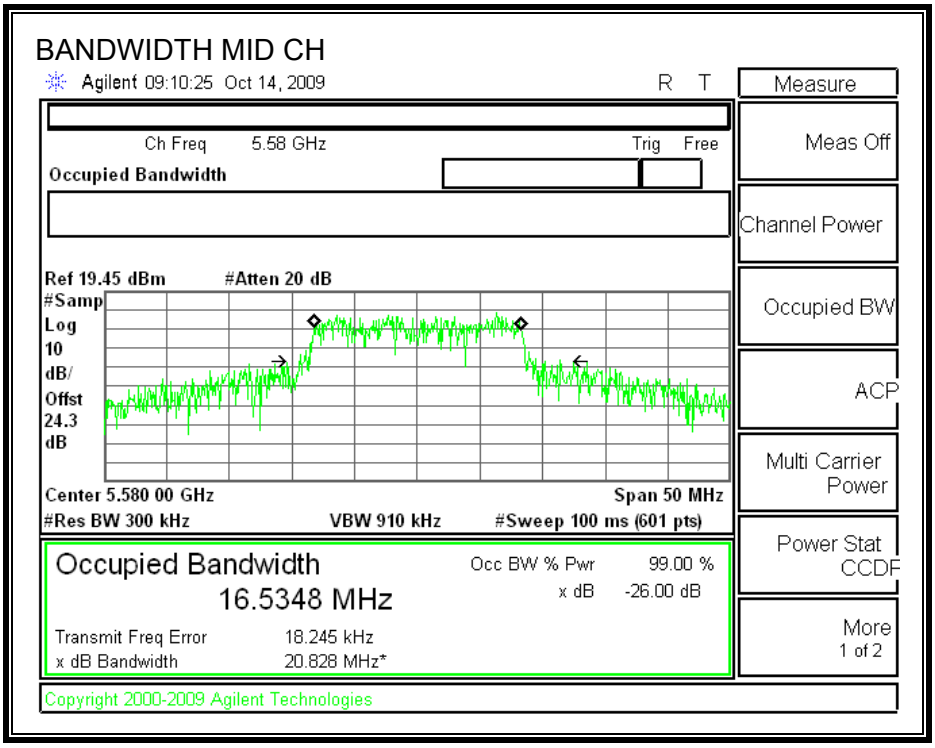
The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

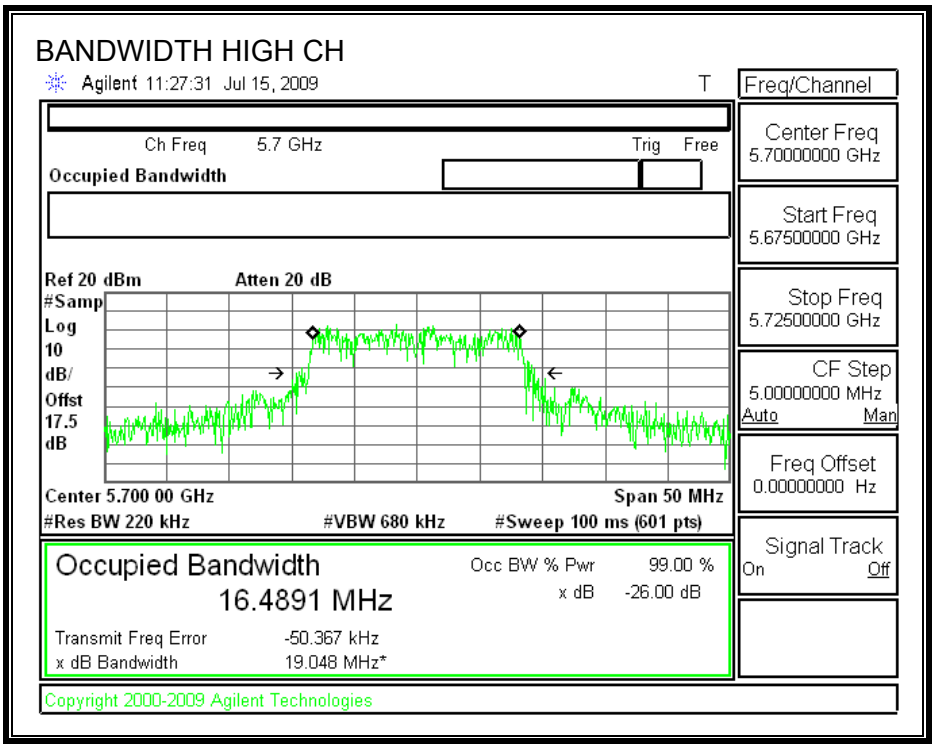
**RESULTS**

| Channel | Frequency (MHz) | 26 dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|---|---|---|---|
| Low | 5500 | 18.9210 | 16.5224 |
| Mid | 5580 | 20.8280 | 16.5348 |
| High | 5700 | 19.0480 | 16.4891 |

**26 dB and 99% BANDWIDTH**





## 7.7.2. OUTPUT POWER

**LIMITS**

FCC §15.407 (a) (1)
IC RSS-210 A9.2 (1)

Antenna gain of Chain 1 = antenna gain of Chain 2.

| Antenna Gain (dBi) | 10 Log (# Tx Chains) (dB) | Effective Legacy Gain (dBi) |
|---|---|---|
| 3 | 3.01 | 6.01 |

For the 5.47-5.725 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**TEST PROCEDURE**

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.
The transmitter output operates continuously therefore Method # 1 is used.

**RESULTS**

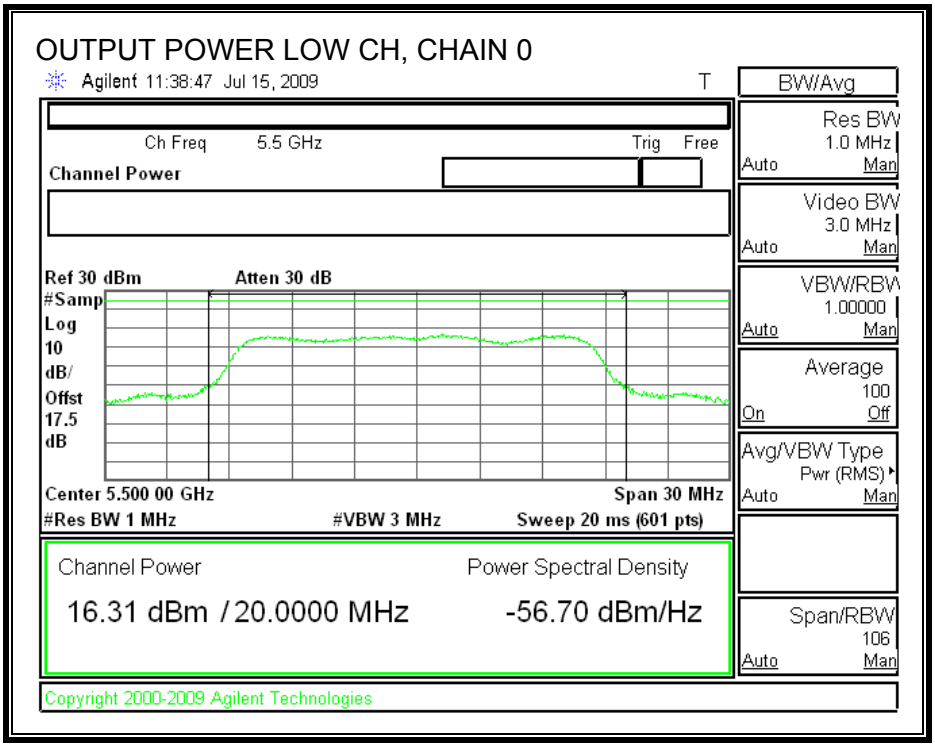
**Limit**

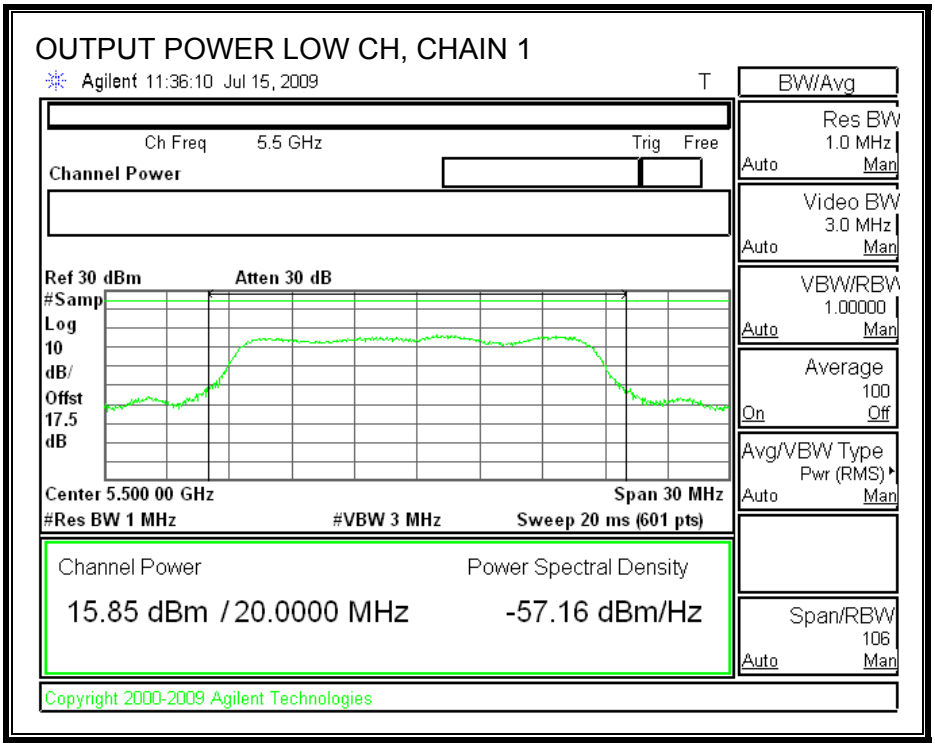
| Channel | Frequency (MHz) | Fixed Limit (dBm) | B (MHz) | 11 + 10 Log B Limit (dBm) | Effective Ant Gain (dBi) | Limit (dBm) |
|---|---|---|---|---|---|---|
| Low | 5500 | 24 | 18.9210 | 23.77 | 6.01 | 23.76 |
| Mid | 5580 | 24 | 20.8280 | 24.19 | 6.01 | 23.99 |
| High | 5700 | 24 | 19.0480 | 23.80 | 6.01 | 23.79 |

**Individual Chain Results**

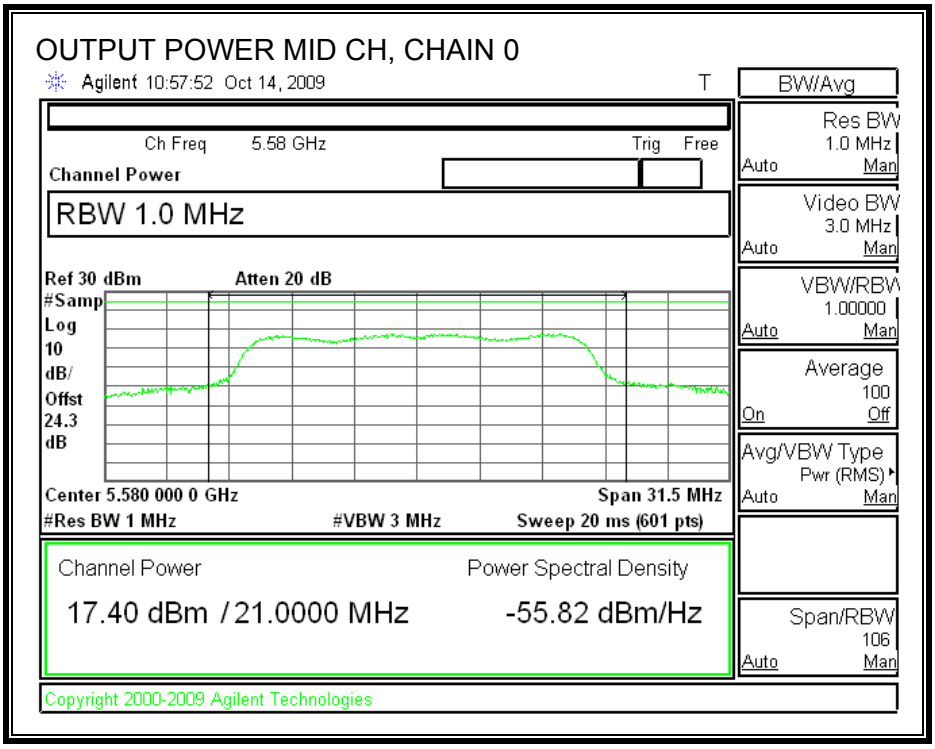
| Channel | Frequency (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|
| Low | 5500 | 16.31 | 15.85 | 19.10 | 23.76 | -4.66 |
| Mid | 5580 | 17.40 | 16.26 | 19.88 | 23.99 | -4.11 |
| High | 5700 | 14.47 | 13.84 | 17.18 | 23.79 | -6.61 |

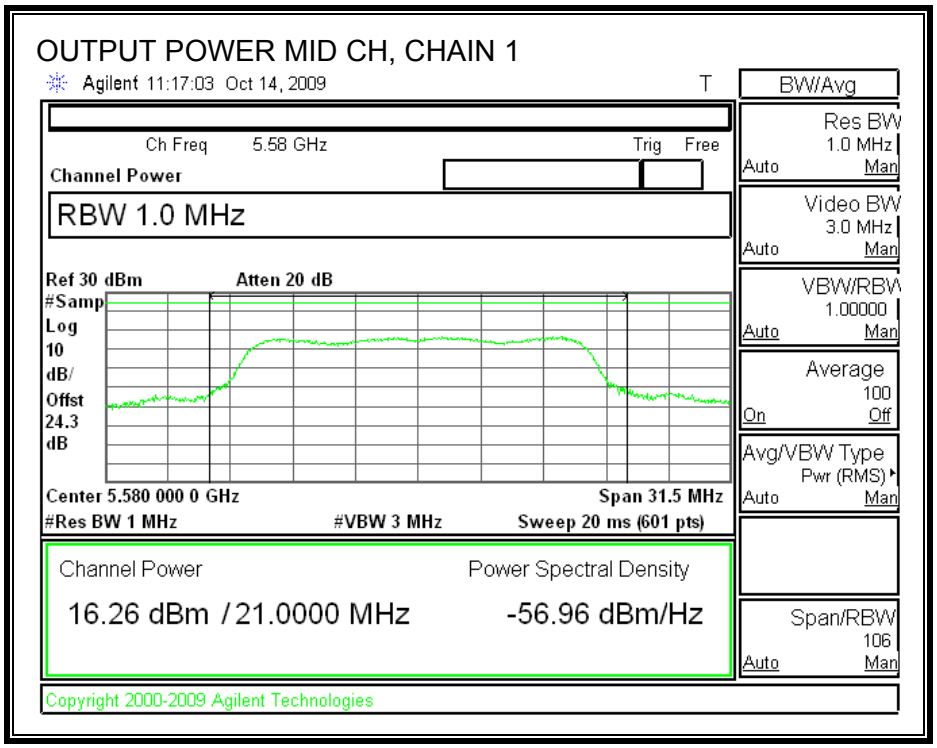
**OUTPUT POWER, LOW CHANNEL**



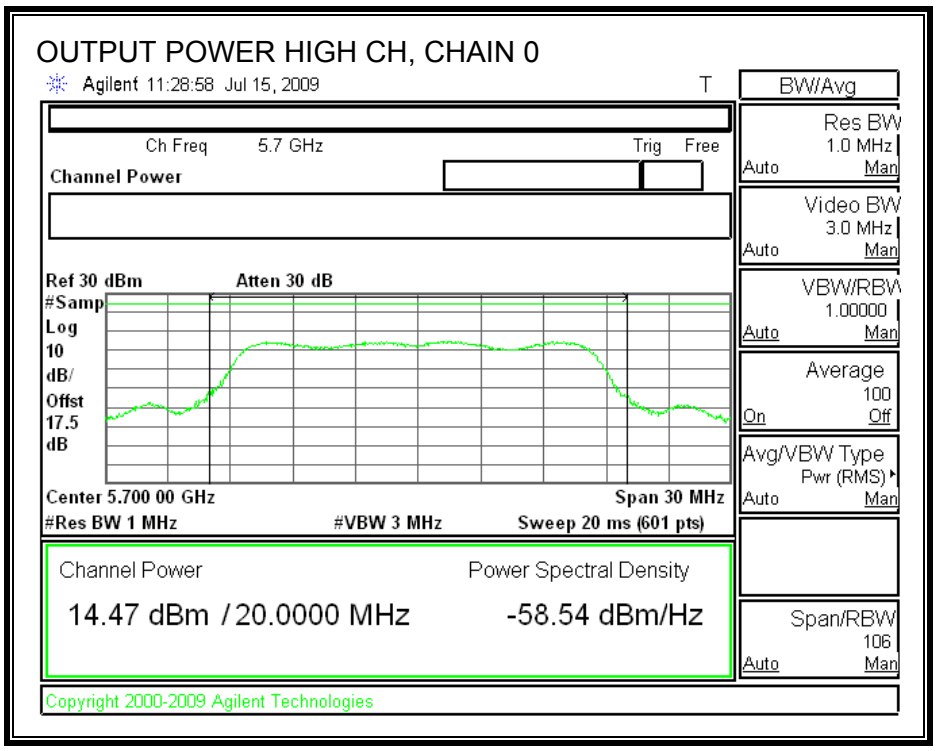



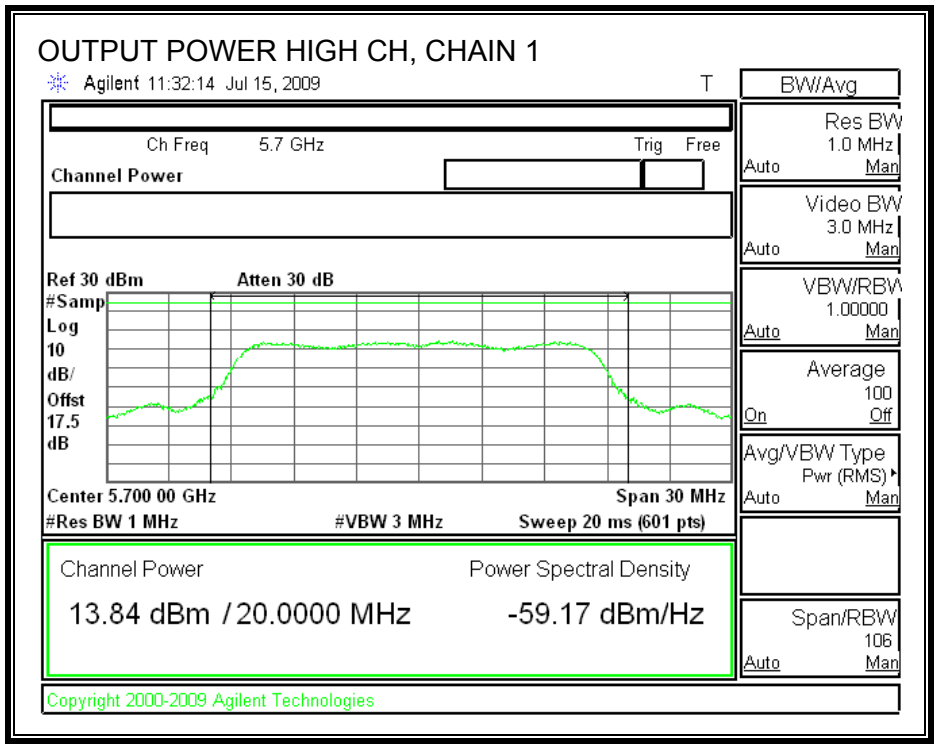
**OUTPUT POWER, MID CHANNEL**



**OUTPUT POWER, HIGH CHANNEL**



## 7.7.3. AVERAGE POWER

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a power meter.

**RESULTS**

The cable assembly insertion loss of 11.3 dB (including 10 dB pad and 1.3 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) | Total Power (dBm) |
|---|---|---|---|---|
| Low | 5500 | 15.83 | 16.25 | 19.06 |
| Mid | 5580 | 16.09 | 15.85 | 18.98 |
| High | 5700 | 14.49 | 13.85 | 17.19 |

## 7.7.4. PEAK POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

Use this table if antenna gain for Chain 1 = antenna gain for Chain 2

| Antenna Gain (dBi) | 10 Log (# Tx Chains) (dB) | Effective Legacy Gain (dBi) |
|---|---|---|
| 3 | 3.01 | 6.01 |

For the 5.47-5.725 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum effective antenna gain is 6.01 dBi, therefore the limit is 10.99 dBm.

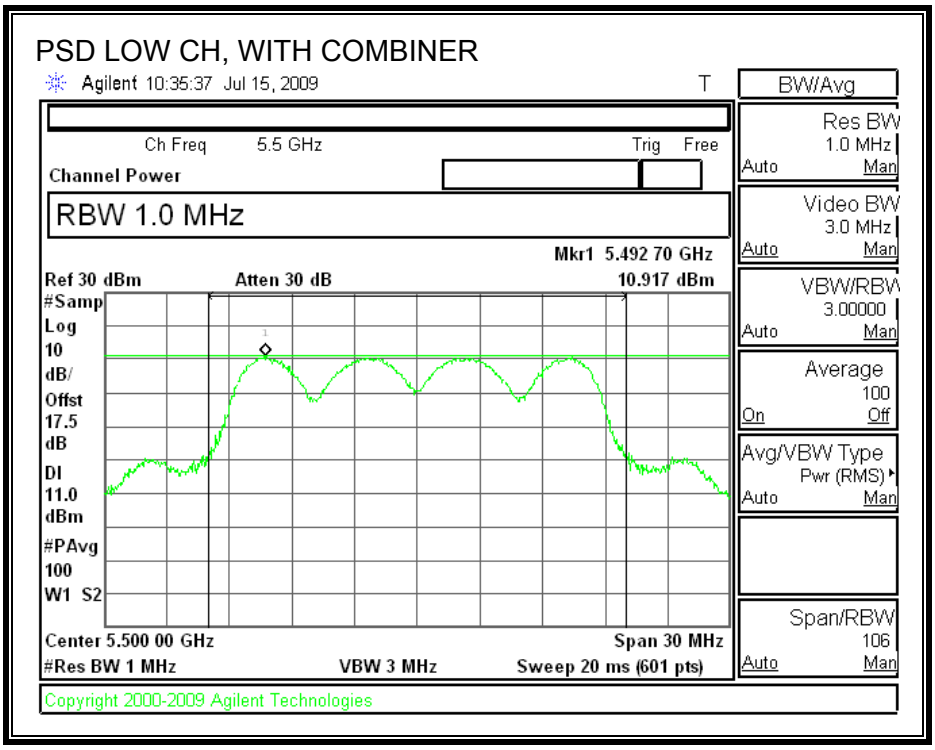
**TEST PROCEDURE**

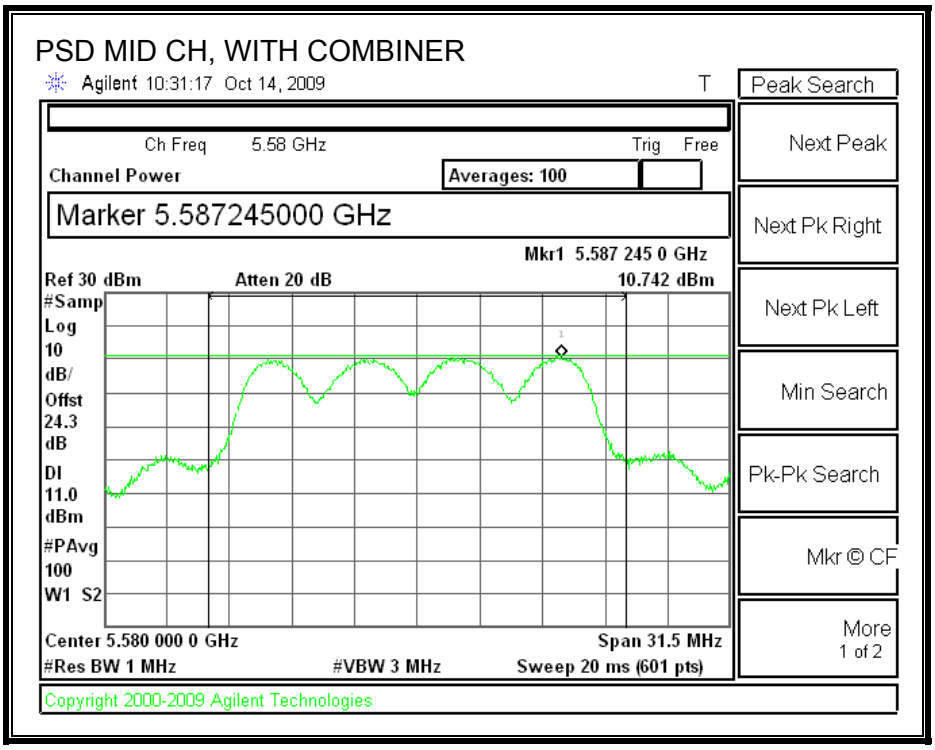
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

**RESULTS**

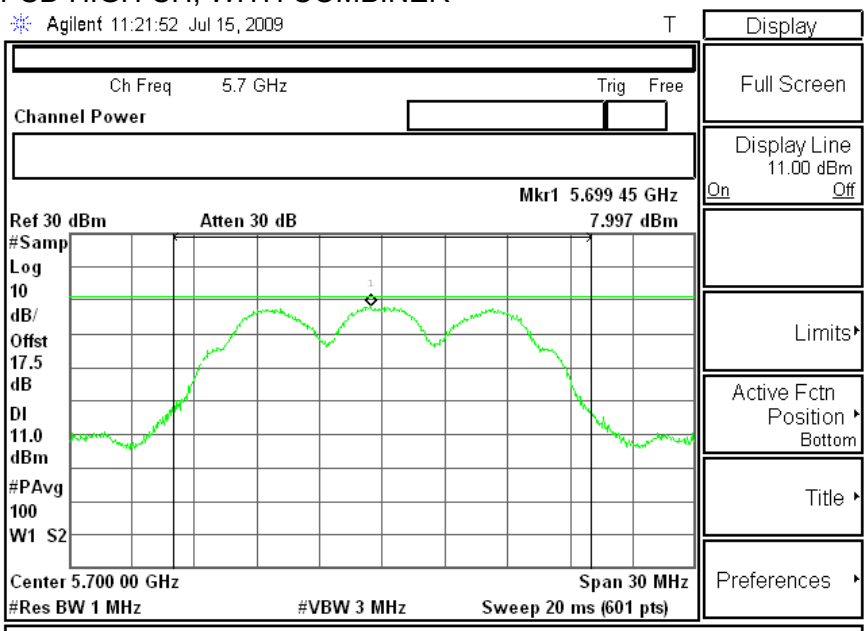
| Channel | Frequency (MHz) | PPSD With Combiner (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| **Low** | **5500** | **10.92** | **10.99** | **-0.07** |
| **Mid** | **5580** | **10.74** | **10.99** | **-0.25** |
| **High** | **5700** | **8.00** | **10.99** | **-2.99** |

**POWER SPECTRAL DENSITY WITH COMBINER**



PSD HIGH CH, WITH COMBINER



## 7.7.5. PEAK EXCURSION

**LIMITS**

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

**TEST PROCEDURE**

The transmitter outputs are connected to the spectrum analyzer via a combiner.

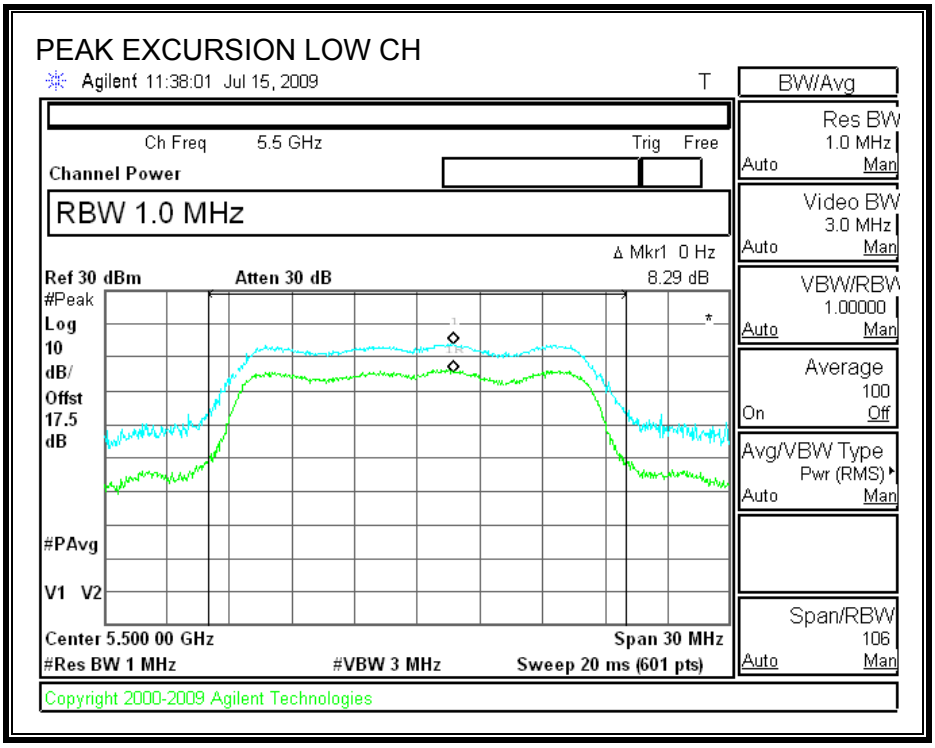
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

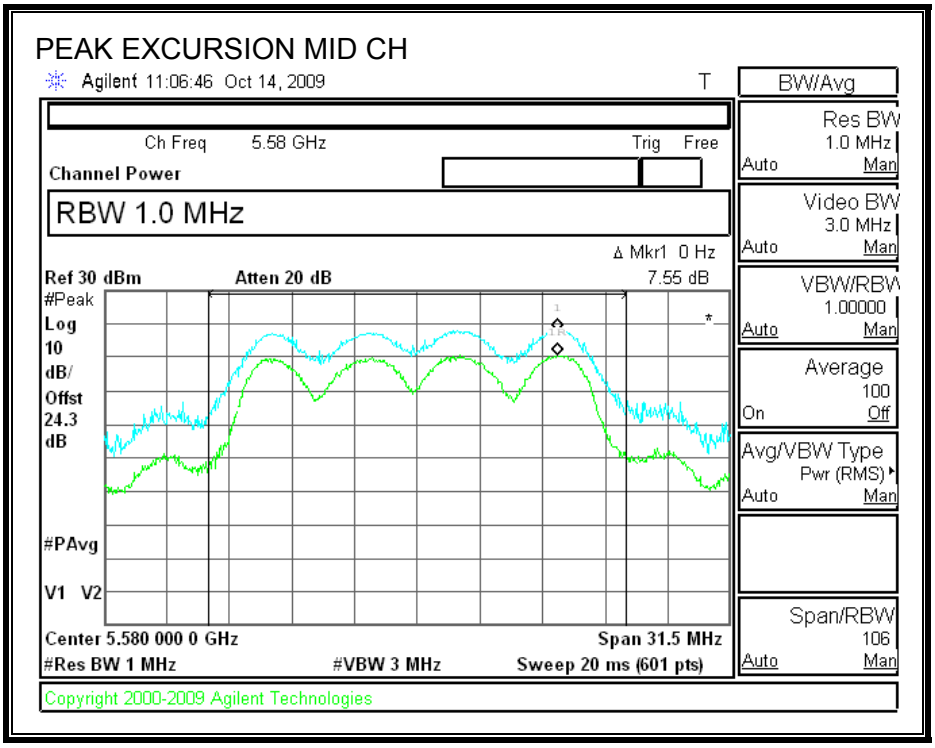
Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

**RESULTS**

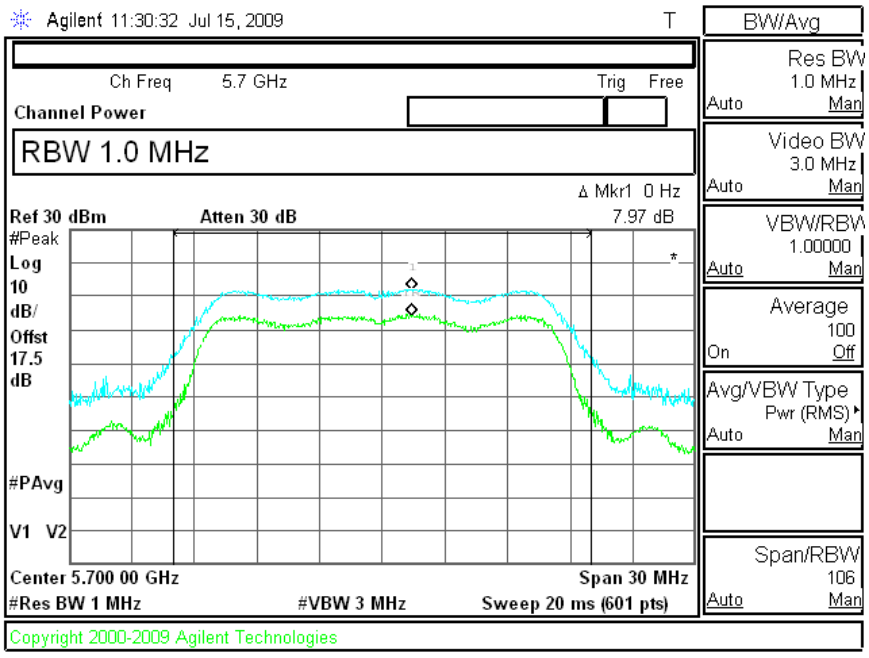
| Channel | Frequency (MHz) | Peak Excursion (dB) | Limit (dB) | Margin (dB) |
|---|---|---|---|---|
| Low | 5500 | 8.29 | 13 | -4.71 |
| Mid | 5580 | 7.55 | 13 | -5.45 |
| High | 5700 | 7.97 | 13 | -5.03 |

**PEAK EXCURSION**



PEAK EXCURSION HIGH CH



## 7.7.6. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.407 (b) (1)

IC RSS-210 A9.3 (1)

For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm / MHz.

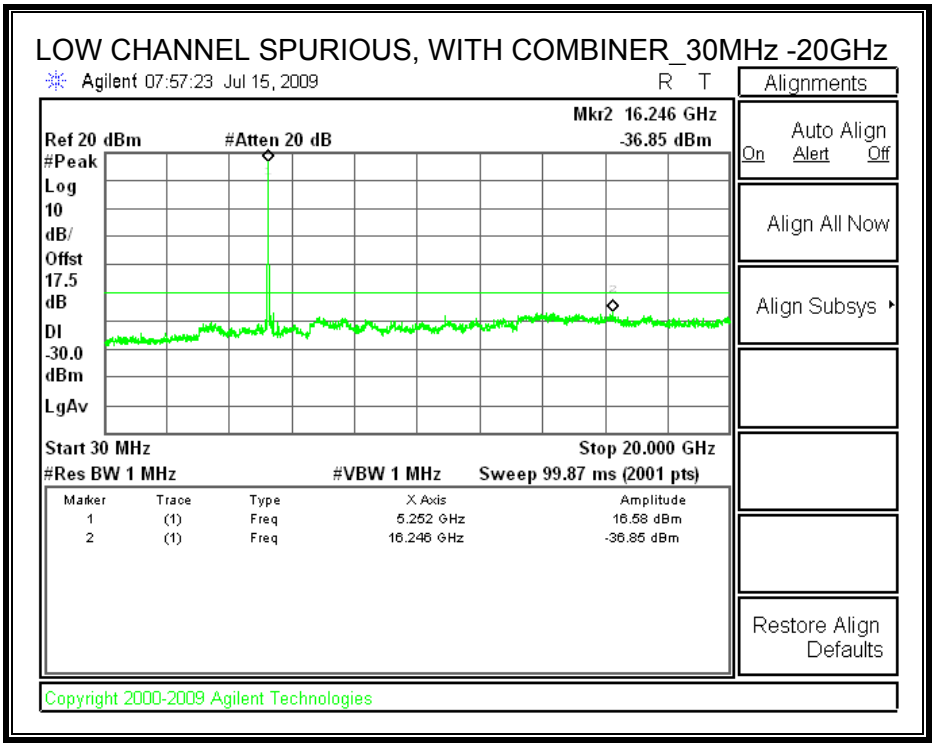
**TEST PROCEDURE**

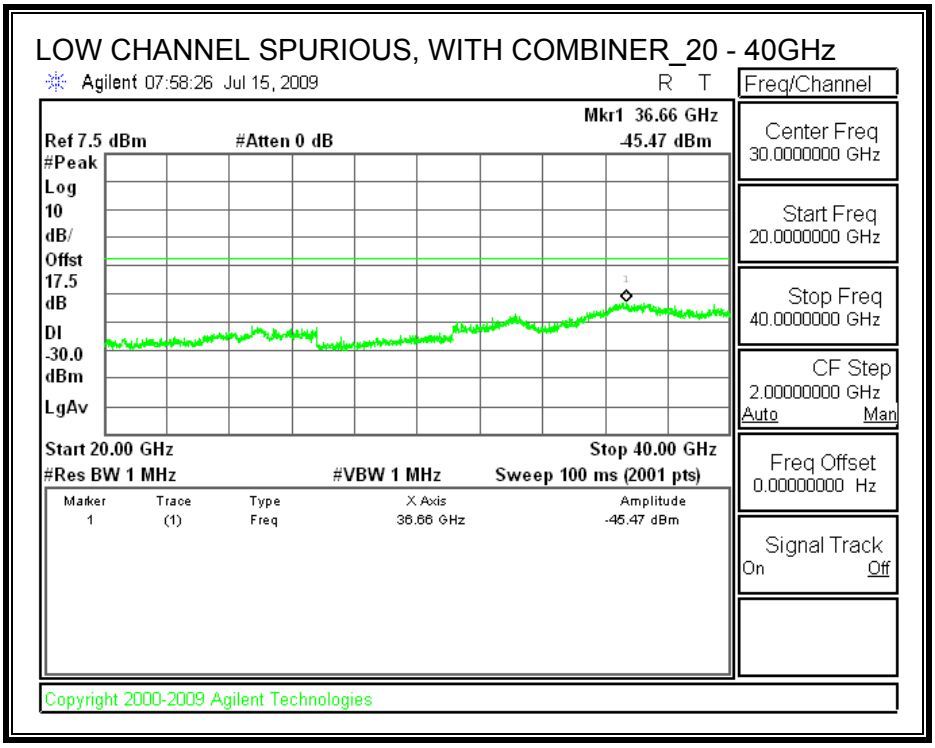
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

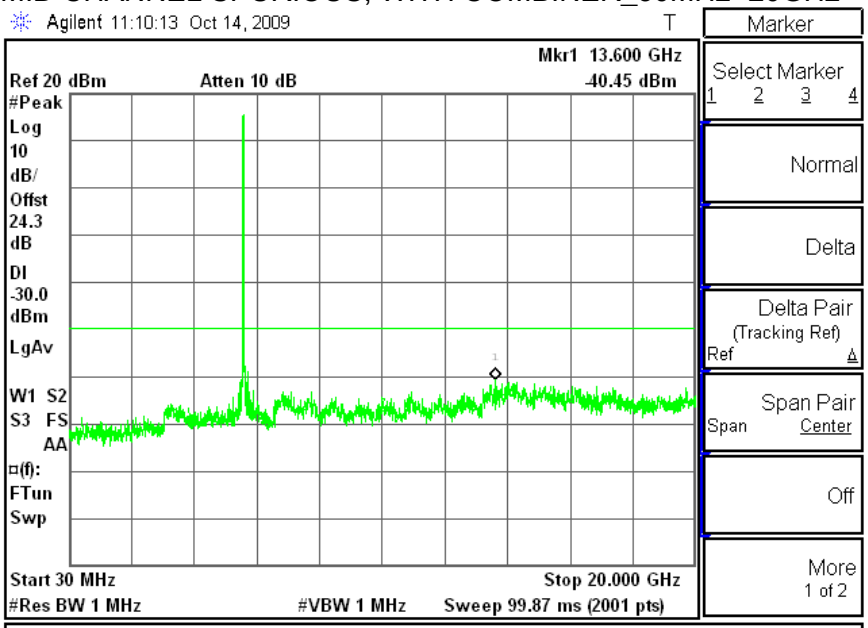
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

**SPURIOUS EMISSIONS WITH COMBINER**

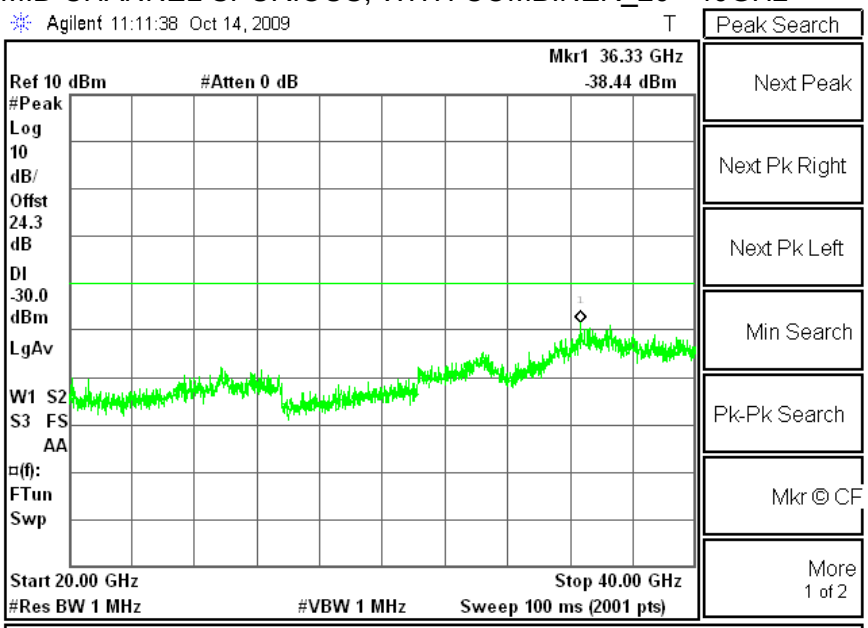


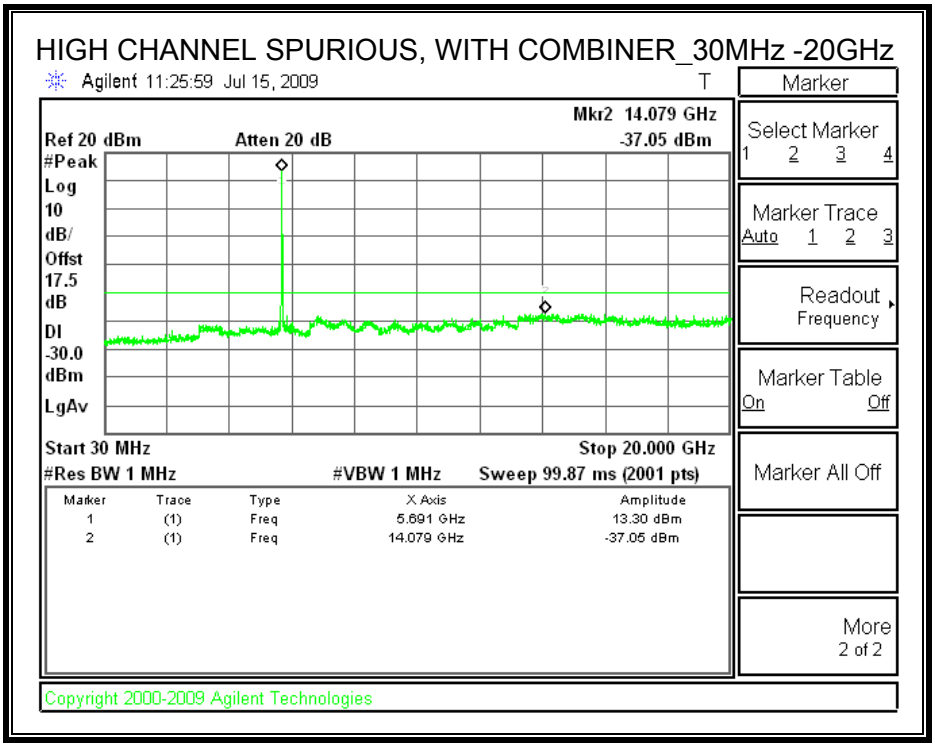
MID CHANNEL SPURIOUS, WITH COMBINER_30MHz -20GHz



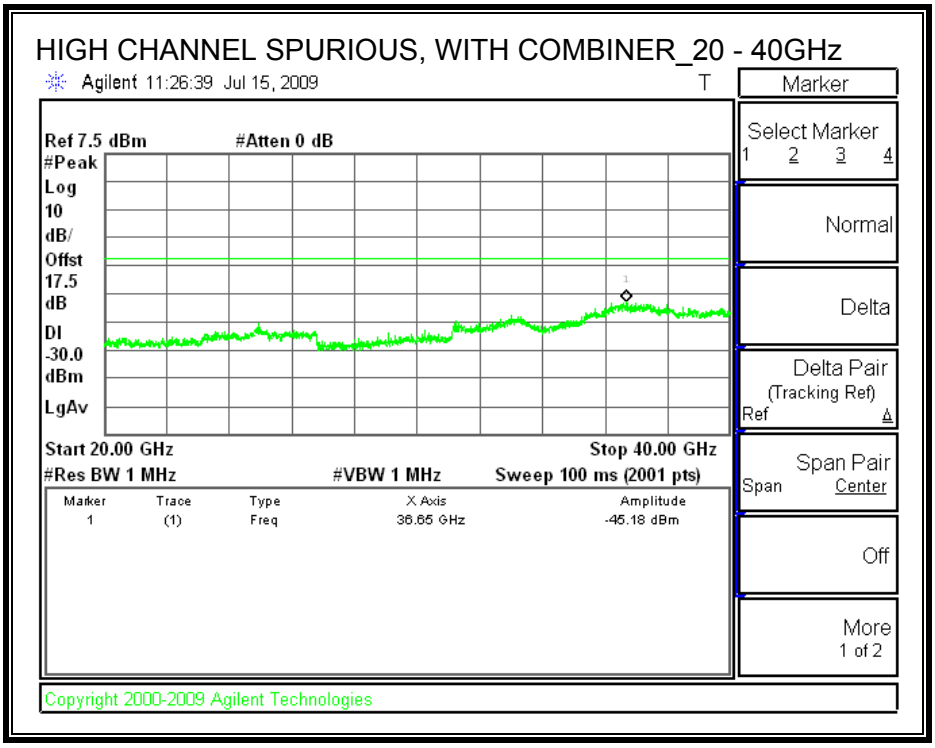

MID CHANNEL SPURIOUS, WITH COMBINER_20 - 40GHz



HIGH CHANNEL SPURIOUS, WITH COMBINER_30MHz -20GHz

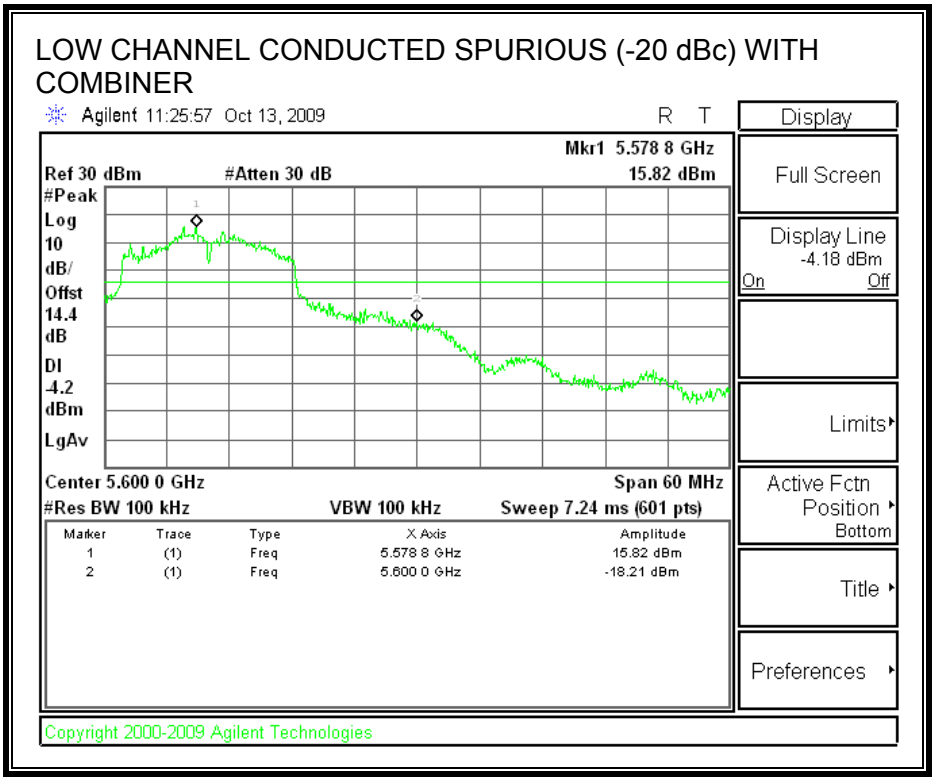



HIGH CHANNEL SPURIOUS, WITH COMBINER_20 - 40GHz

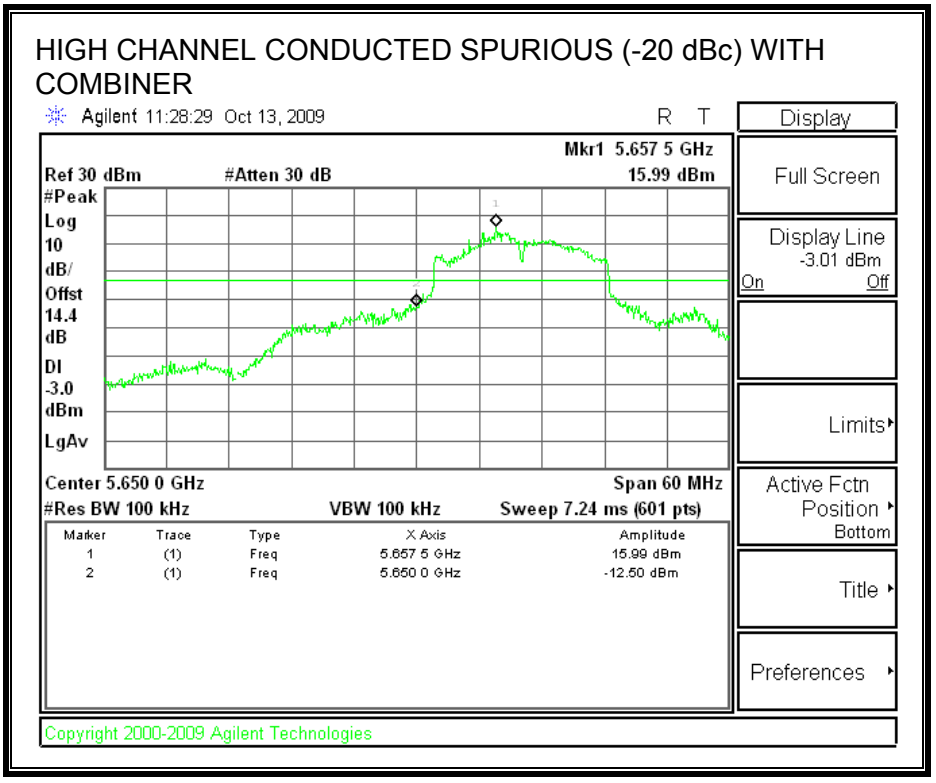


## 7.7.7. CONDUCTED SPURIOUS (-20 dBc)

LOW CHANNEL CONDUCTED SPURIOUS (-20 dBc) WITH COMBINER




HIGH CHANNEL CONDUCTED SPURIOUS (-20 dBc) WITH COMBINER



# 5.6 GHz BAND CHANNEL TESTS FOR 802.11n HT20 MODE

## 7.7.8. 99% & 26 dB BANDWIDTH

**LIMITS**

None; for reporting purposes only.

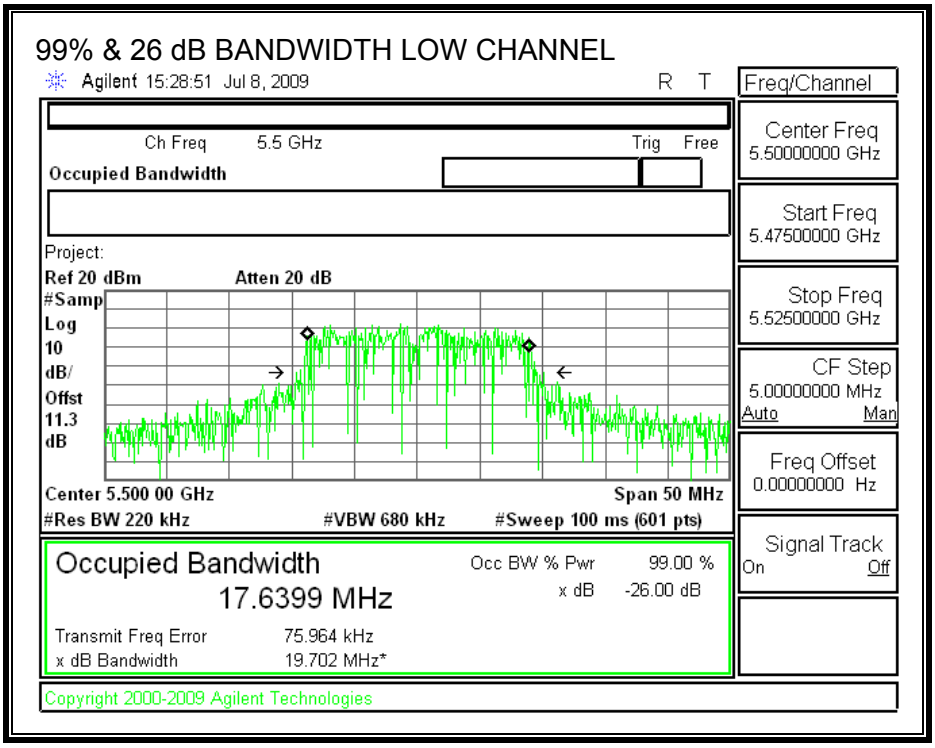
**TEST PROCEDURE**

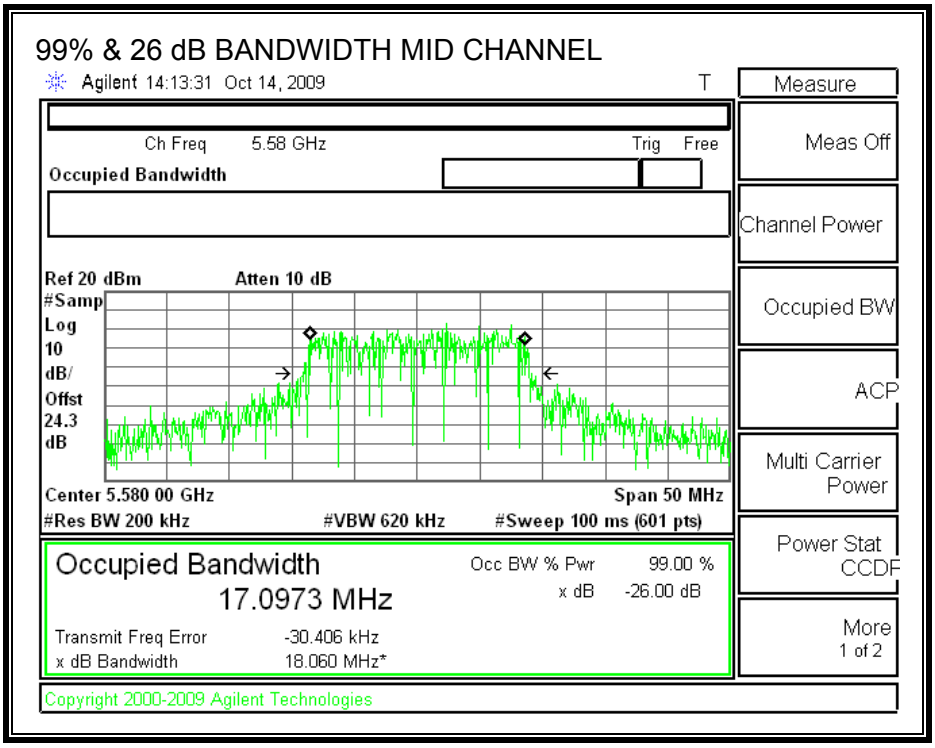
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth measurement function is utilized.

**RESULTS**

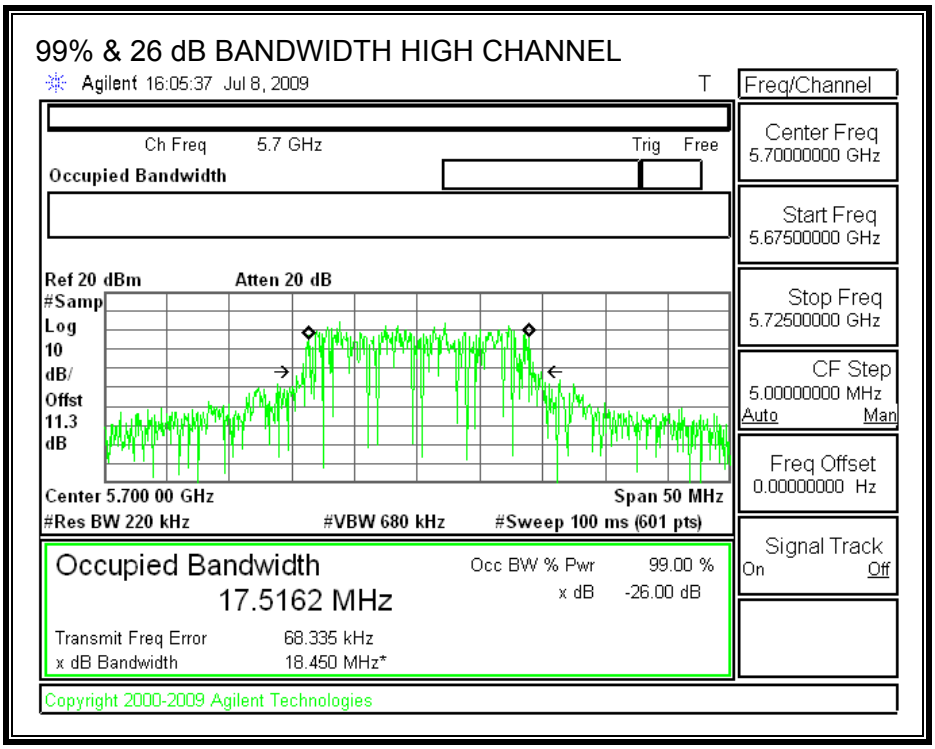
| Channel | Frequency (MHz) | 99% OBW (MHz) | 26 dB BW (MHz) |
|---|---|---|---|
| Low | 5500 | 17.6399 | 19.702 |
| Mid | 5580 | 17.0973 | 18.06 |
| High | 5700 | 17.5162 | 18.450 |

**99% & 26 dB BANDWIDTH**



99% & 26 dB BANDWIDTH HIGH CHANNEL



## 7.7.9. OUTPUT POWER

**LIMITS**

FCC §15.407 (a) (2)
IC RSS-210 A9.2 (2)

For the 5.47-5.725 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**TEST PROCEDURE**

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.
The transmitter output operates continuously therefore Method # 1 is used.

**RESULTS**

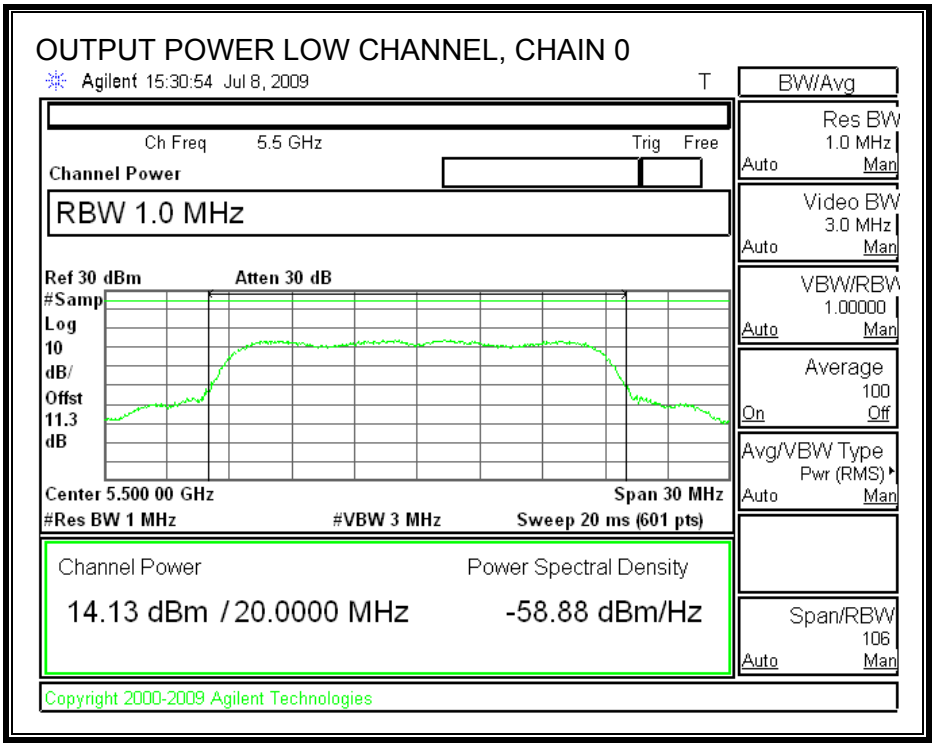
**Limit**

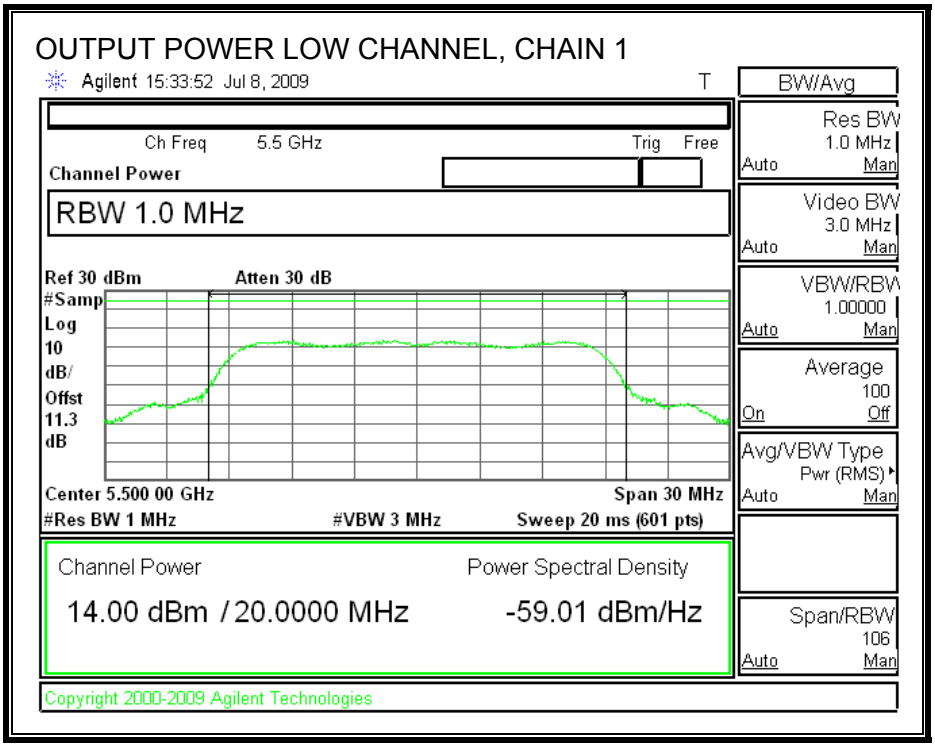
| Channel | Freq (MHz) | Fixed Limit (dBm) | B (MHz) | 11 + 10 Log B Limit (dBm) | Antenna Gain (dBi) | Limit (dBm) |
|---|---|---|---|---|---|---|
| Low | 5500 | 24 | 19.702 | 23.95 | 3 | 23.95 |
| Mid | 5580 | 24 | 18.06 | 23.57 | 3 | 23.57 |
| High | 5700 | 24 | 18.450 | 23.66 | 3 | 23.66 |

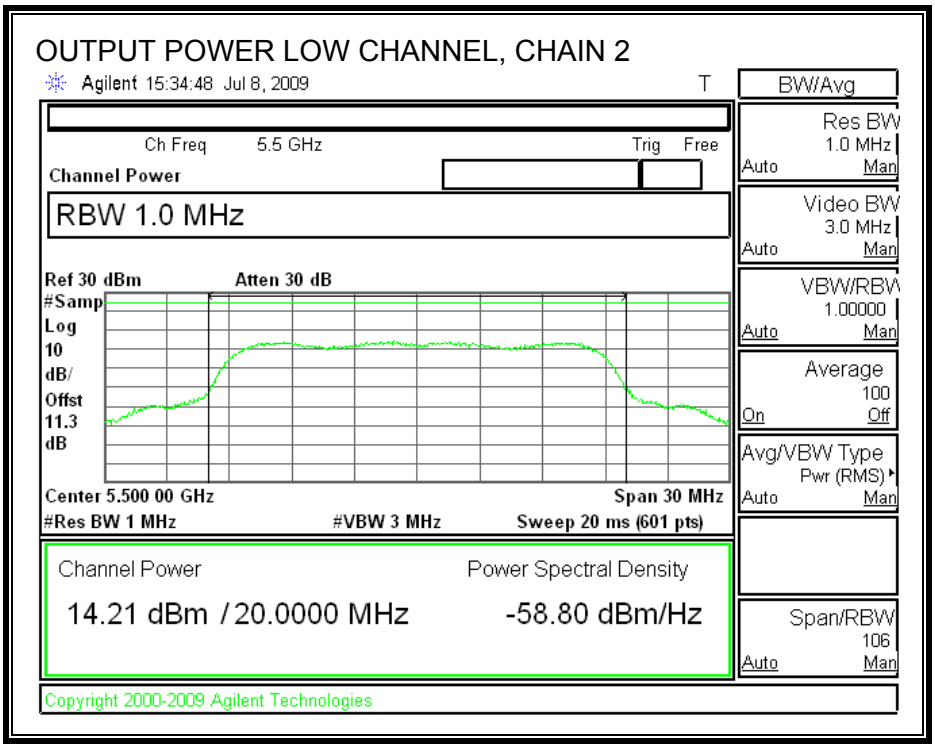
**Individual Chain Results**

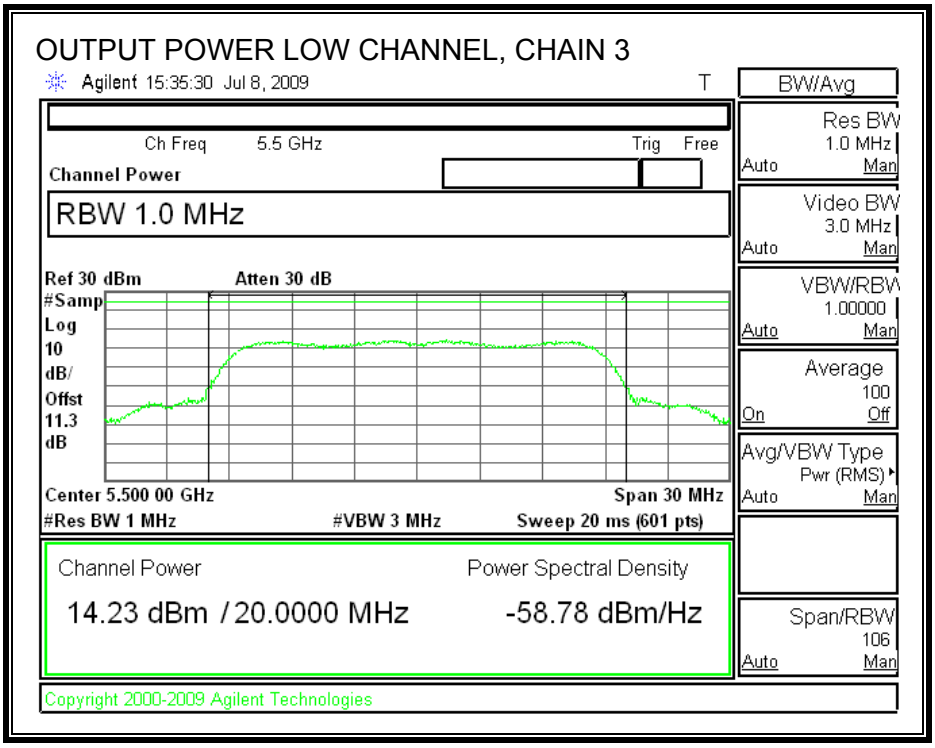
| Channel | Freq (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Chain 3 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| Low | 5500 | 14.13 | 14.00 | 14.21 | 14.23 | 20.16 | 23.95 | -3.78 |
| Mid | 5580 | 13.65 | 13.52 | 13.24 | 13.53 | 19.51 | 23.57 | -4.06 |
| High | 5700 | 14.22 | 14.24 | 14.30 | 14.13 | 20.24 | 23.66 | -3.42 |

**OUTPUT POWER, LOW CHANNEL**

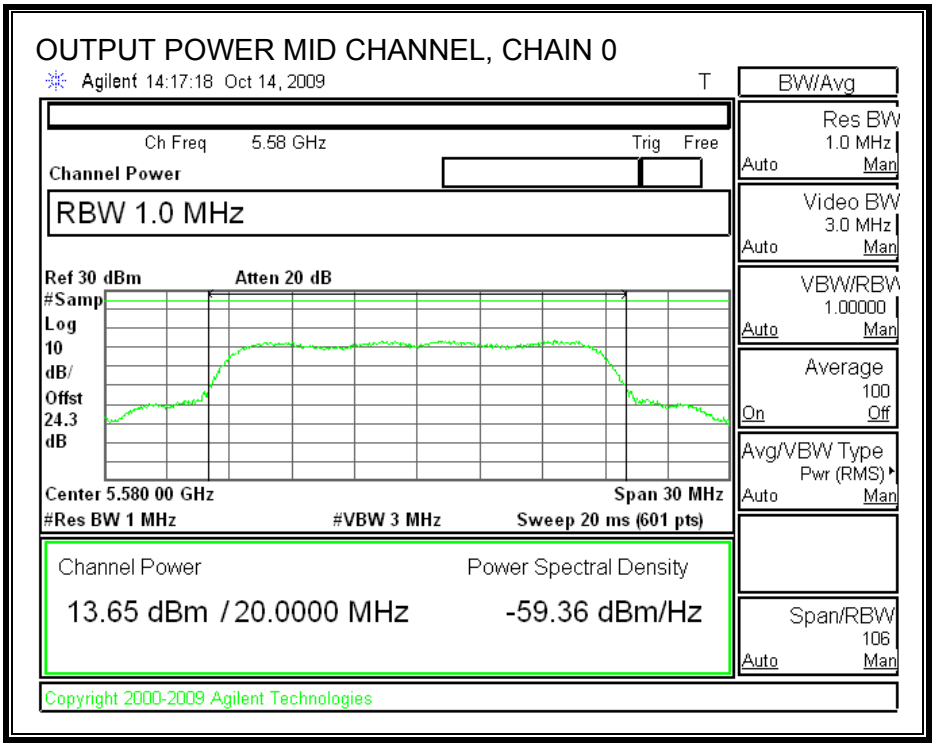


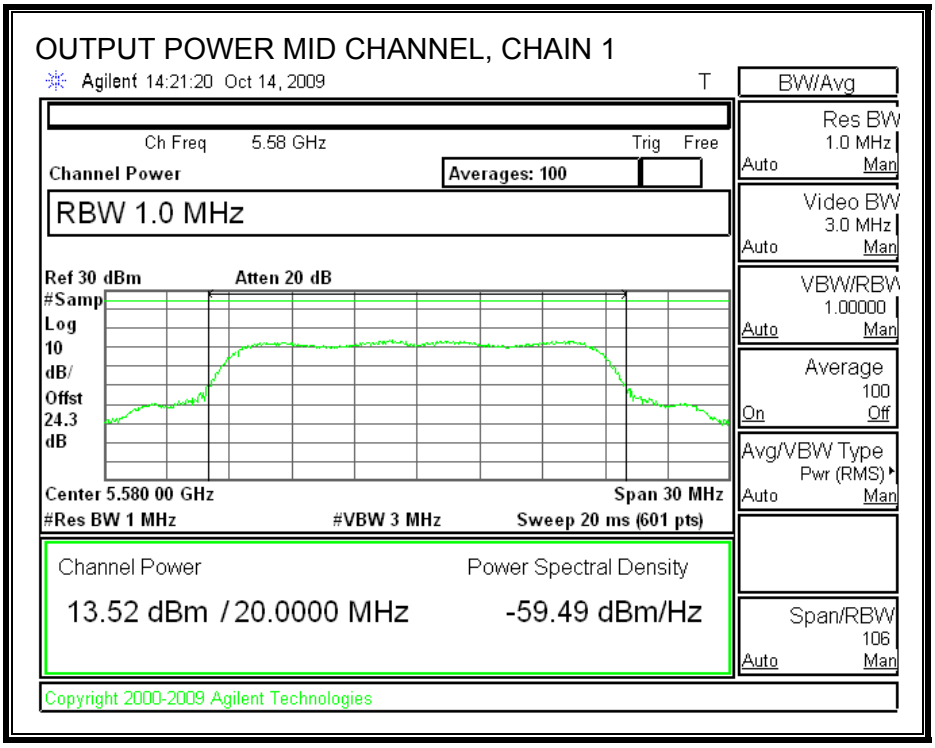





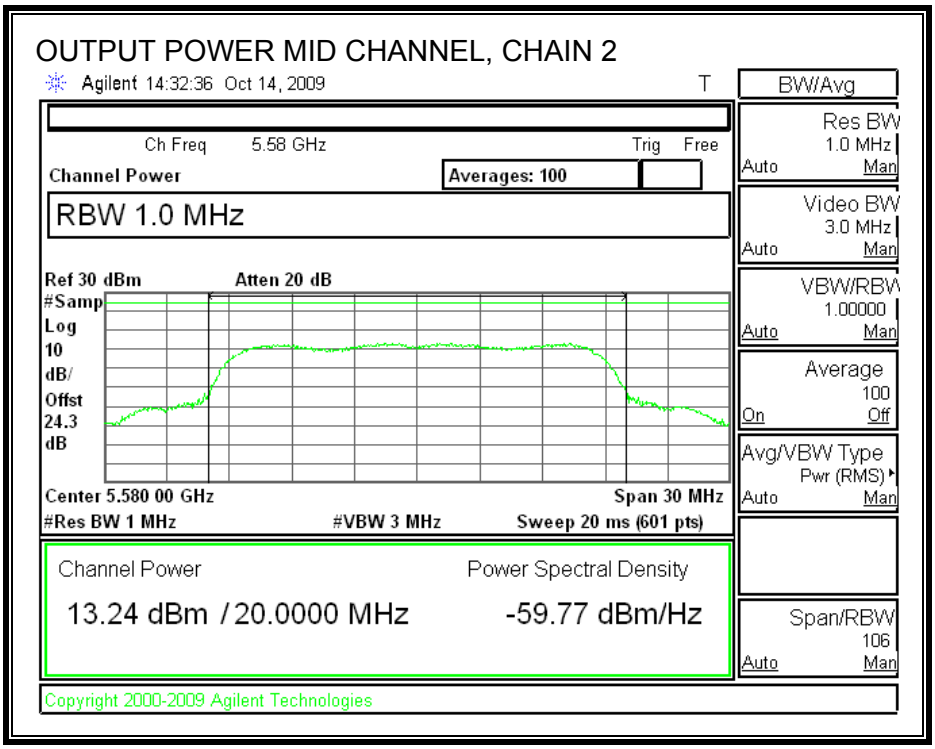



**OUTPUT POWER, MID CHANNEL**

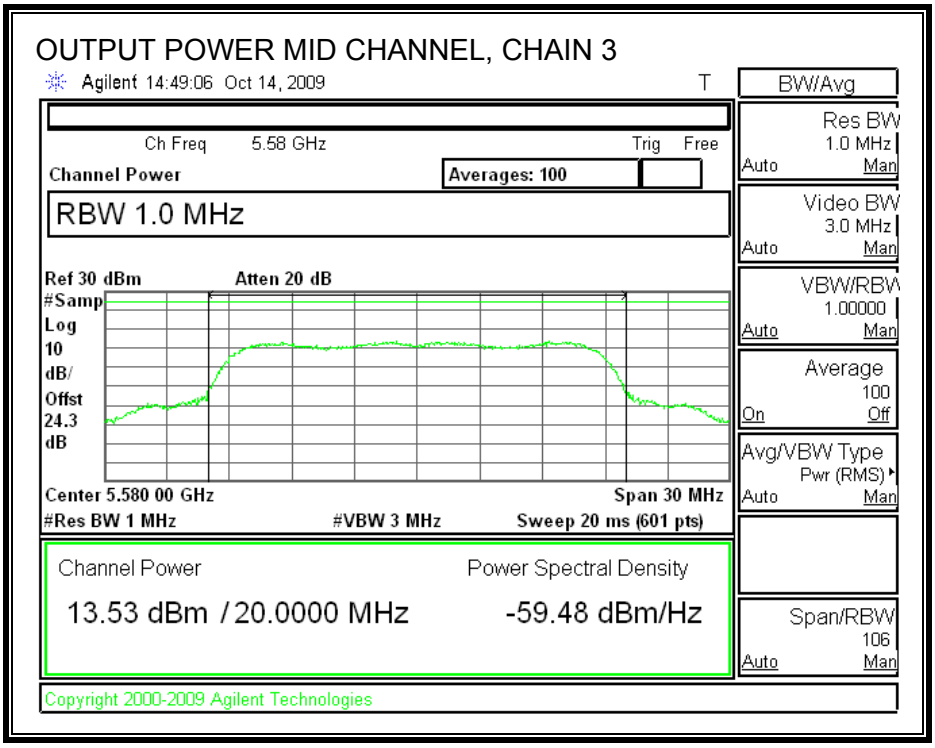


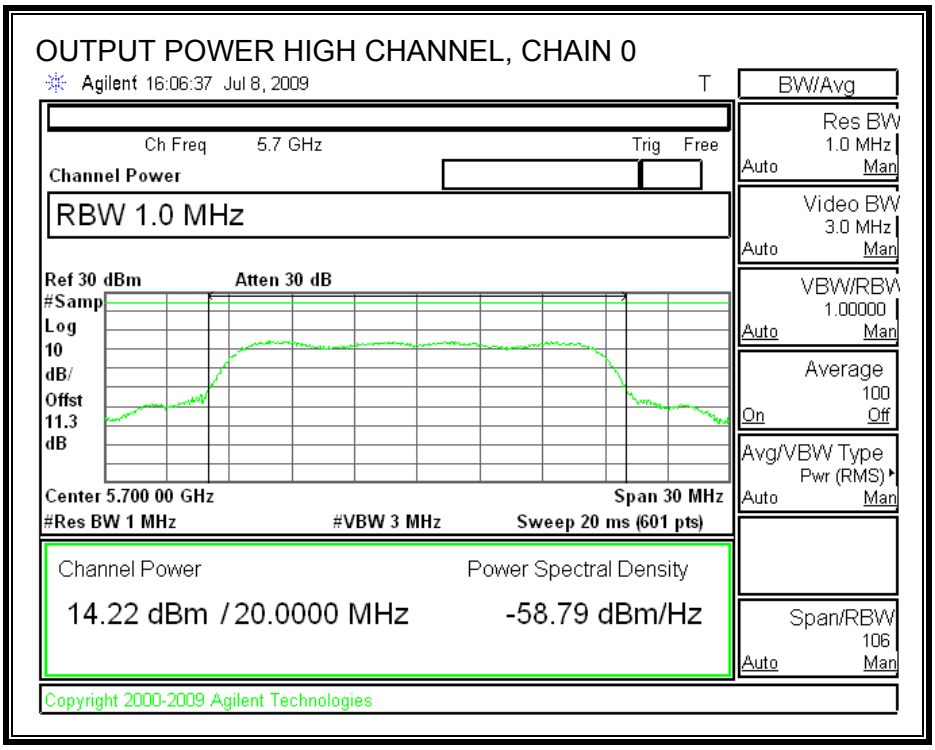
OUTPUT POWER MID CHANNEL, CHAIN 2

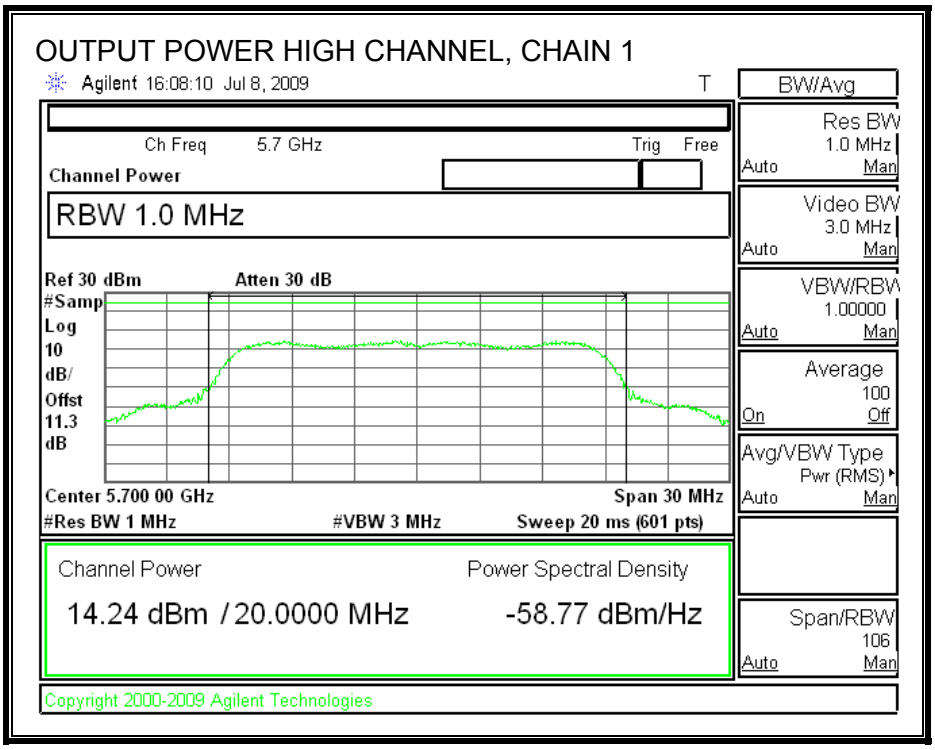


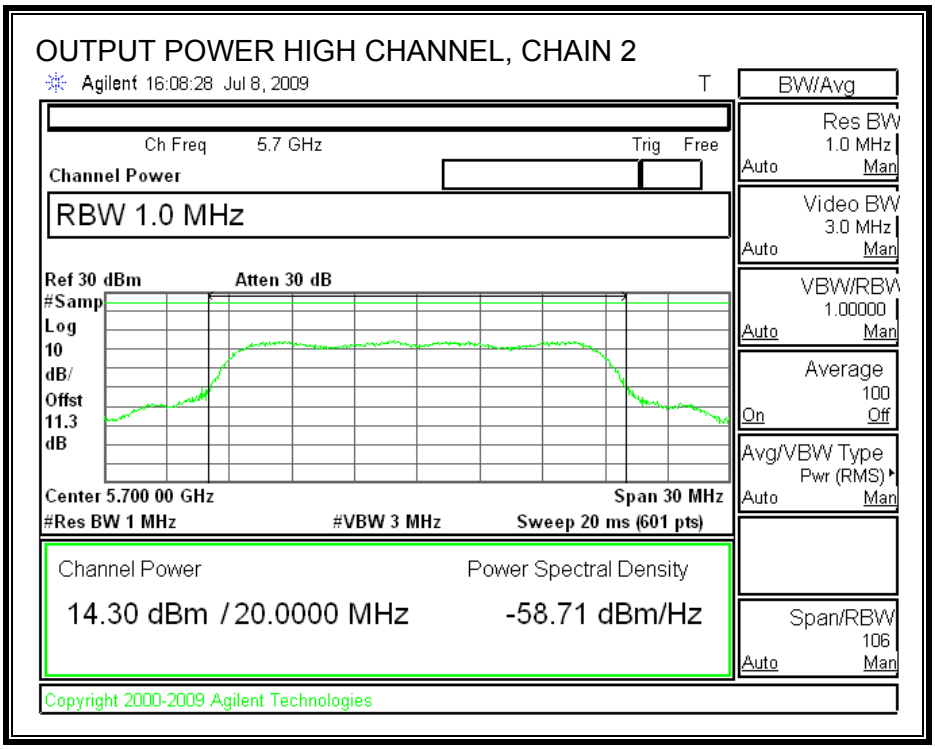

OUTPUT POWER MID CHANNEL, CHAIN 3

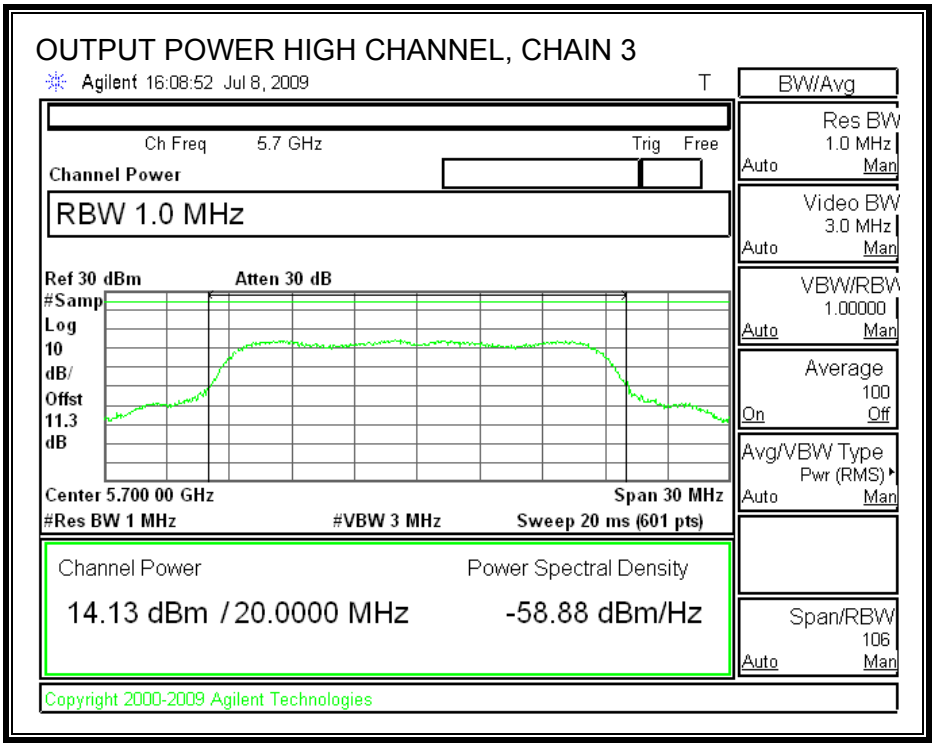


**OUTPUT POWER, HIGH CHANNEL**





## 7.7.10. AVERAGE POWER

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.3 dB (including 10 dB pad and 1.3 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

**RESULTS**

| Channel | Frequency (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Chain 3 Power (dBm) |
|---|---|---|---|---|---|
| Low | 5500 | 14.15 | 14.11 | 14.20 | 14.21 |
| Mid | 5580 | 12.90 | 13.10 | 12.75 | 13.15 |
| High | 5700 | 14.13 | 14.21 | 14.18 | 14.25 |

## 7.7.11. PEAK POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.47-5.725 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 11 dBm.

**TEST PROCEDURE**

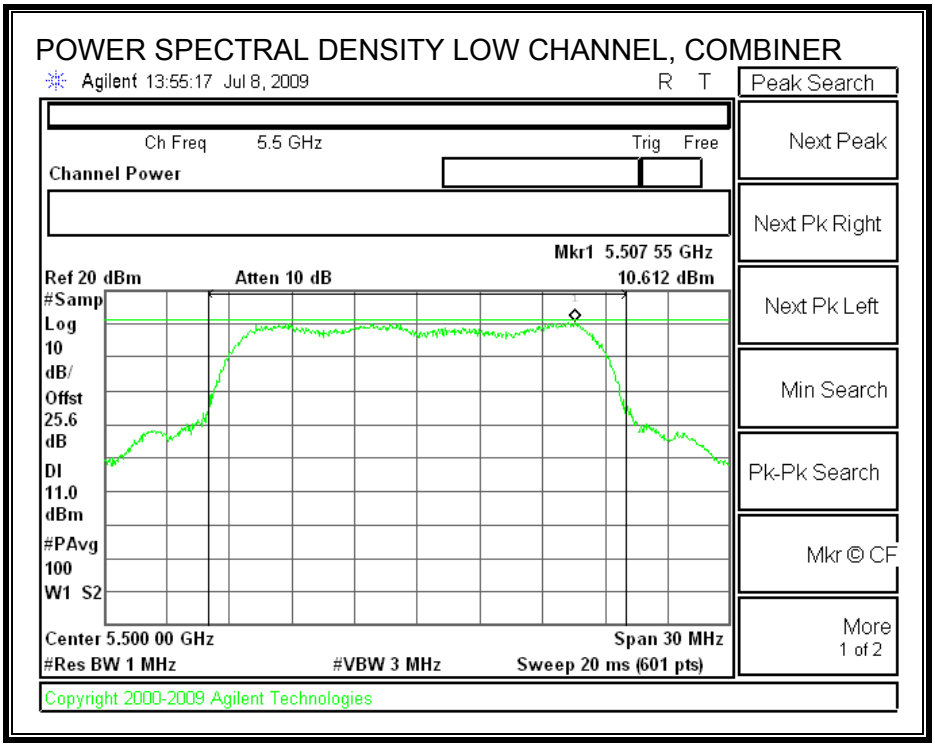
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

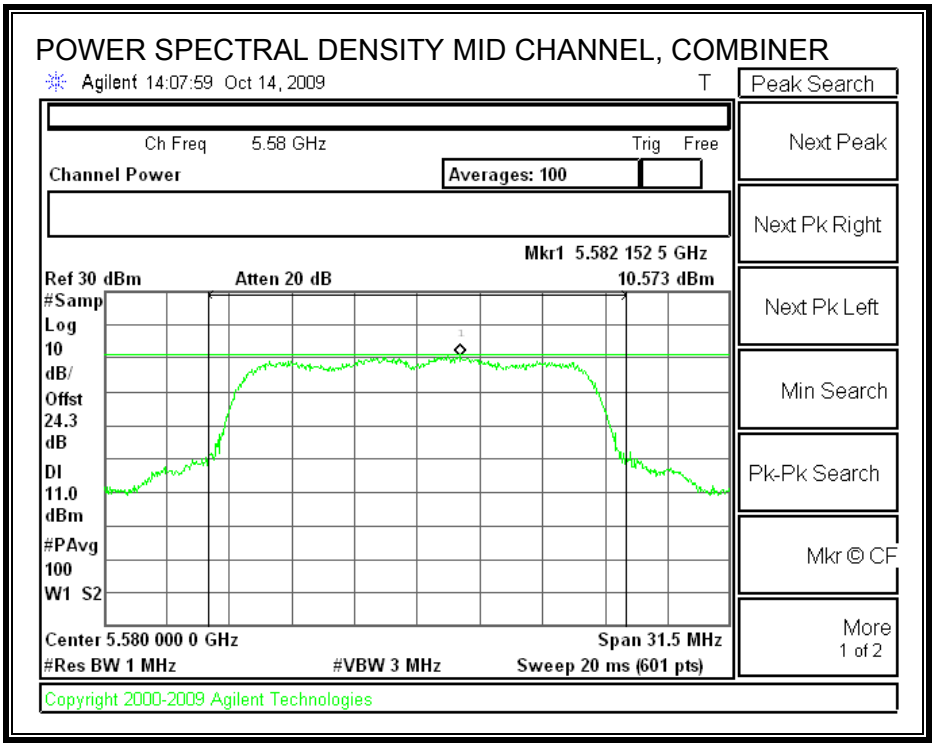
Preliminary tests on individual chains, and on all chains with a combiner, were performed. The worst-case configuration was with a combiner, therefore final test were performed with all chains feeding a combiner.

**RESULTS**

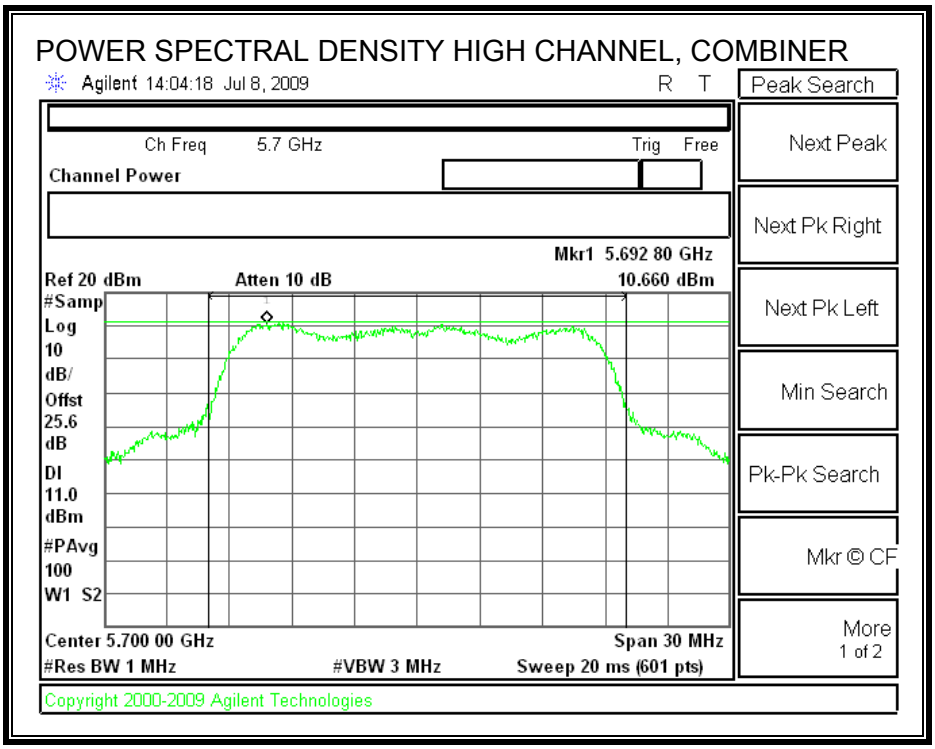
| Channel | Frequency (MHz) | PSD with Combiner (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 5500 | 10.61 | 11 | -0.39 |
| Mid | 5580 | 10.57 | 11 | -0.43 |
| High | 5700 | 10.66 | 11 | -0.34 |

**POWER SPECTRAL DENSITY**



POWER SPECTRAL DENSITY HIGH CHANNEL, COMBINER



## 7.7.12. PEAK EXCURSION

**LIMITS**

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

**TEST PROCEDURE**

The transmitter outputs are connected to the spectrum analyzer via a combiner.

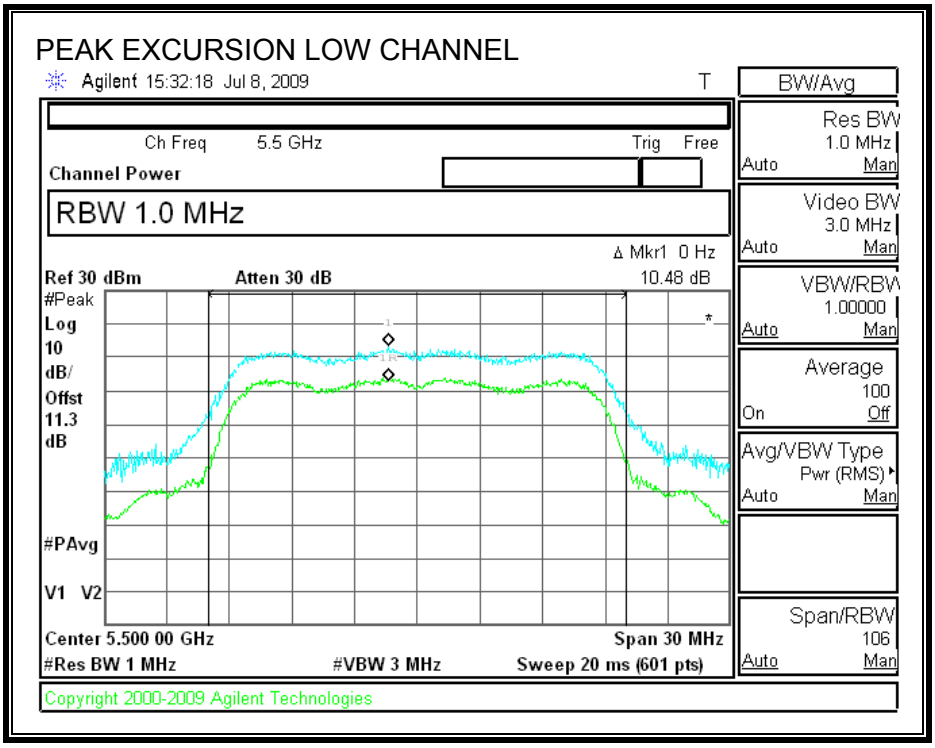
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

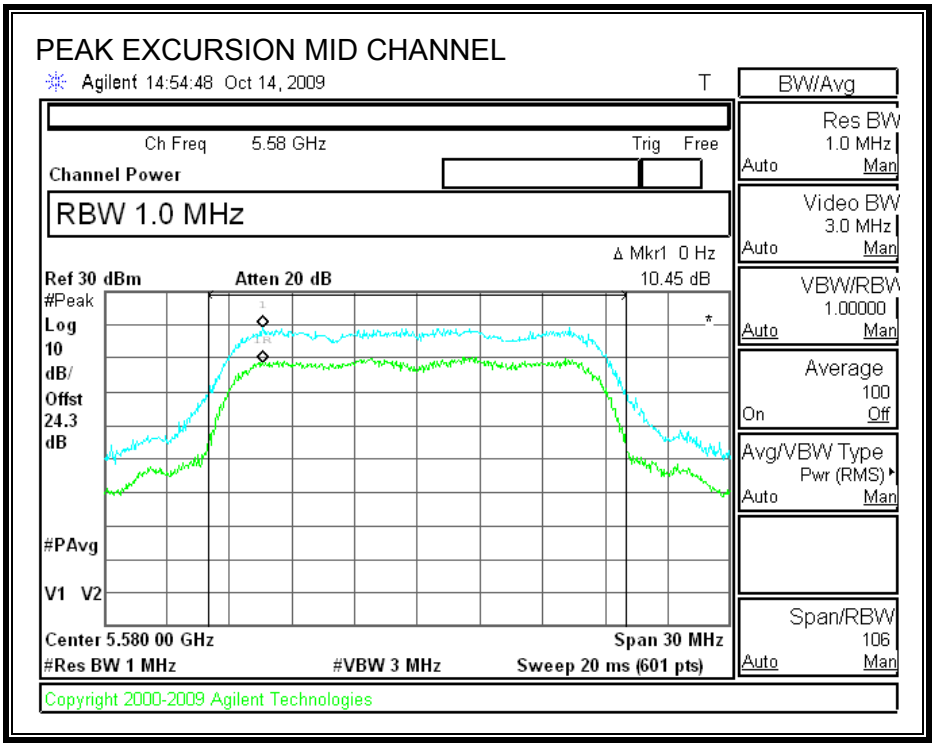
Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

**RESULTS**

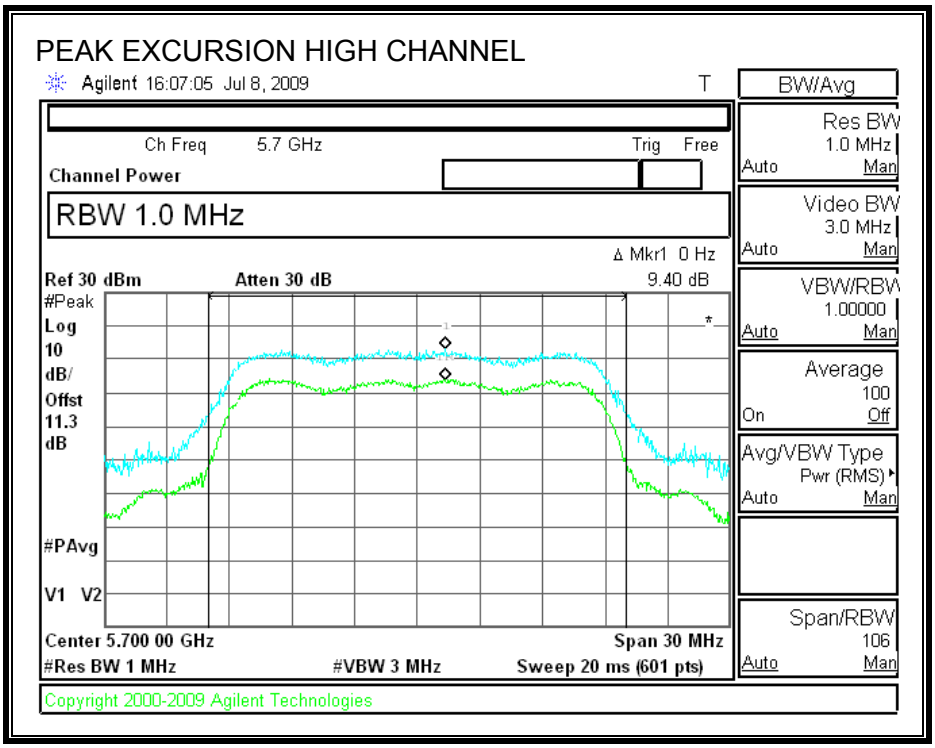
| Channel | Frequency (MHz) | Peak Excursion (dB) | Limit (dB) | Margin (dB) |
|---|---|---|---|---|
| Low | 5500 | 10.48 | 13 | -2.52 |
| Mid | 5580 | 10.45 | 13 | -2.55 |
| High | 5700 | 9.40 | 13 | -3.60 |

**PEAK EXCURSION**



PEAK EXCURSION HIGH CHANNEL



## 7.7.13. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.407 (b) (3)

IC RSS-210 A9.3 (3)

For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm / MHz.

**TEST PROCEDURE**

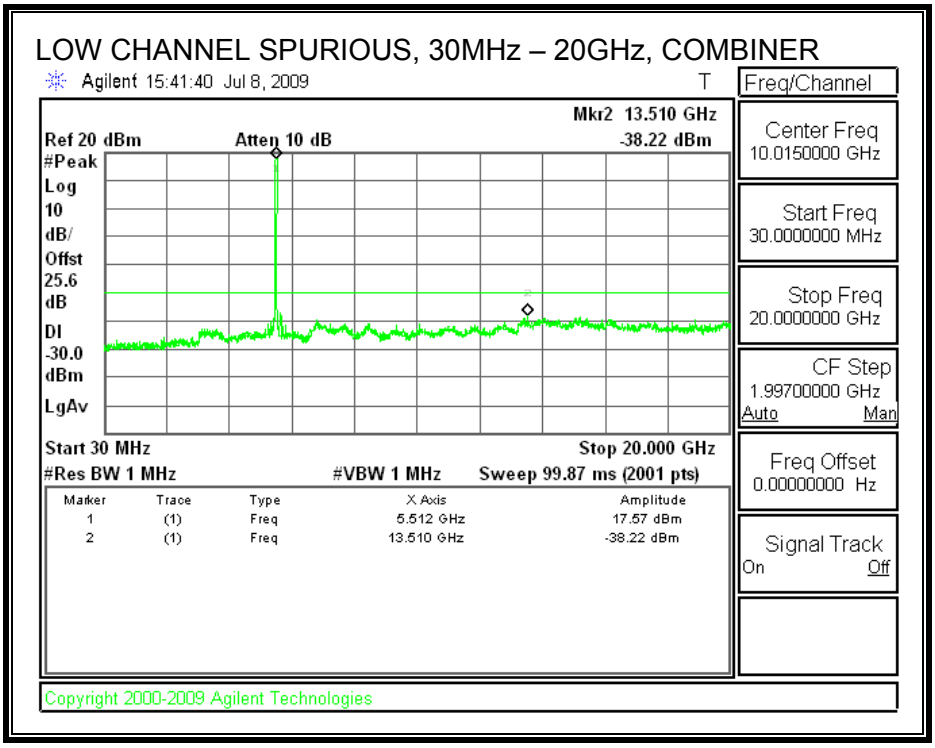
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

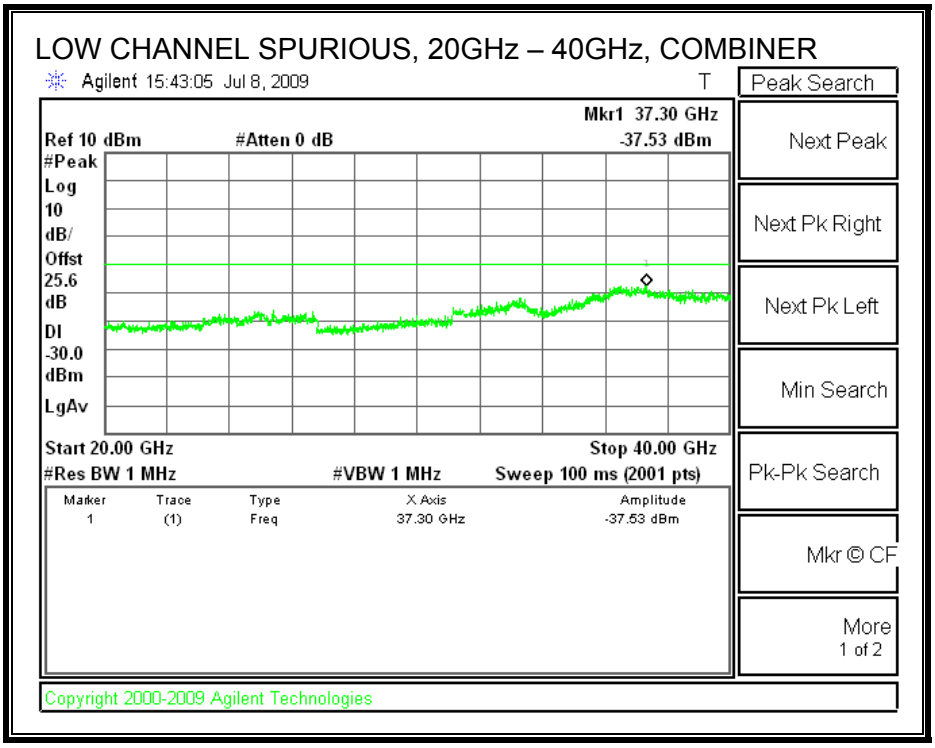
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

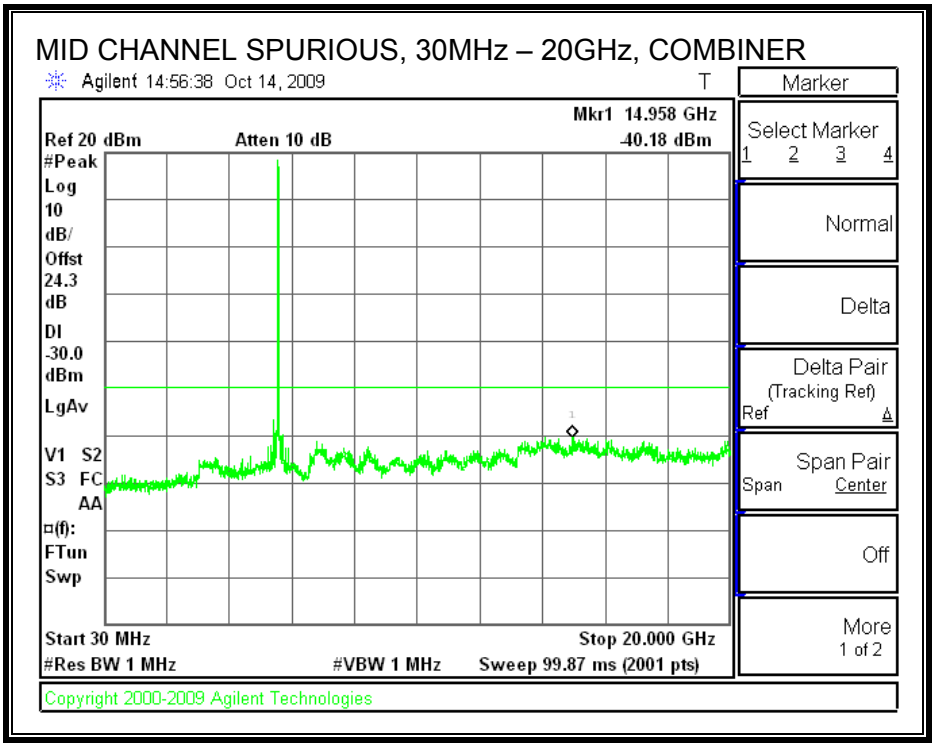
Preliminary tests on individual chains, and on all chains with a combiner, were performed. The worst-case configuration was with a combiner, therefore final test were performed with all chains feeding a combiner.

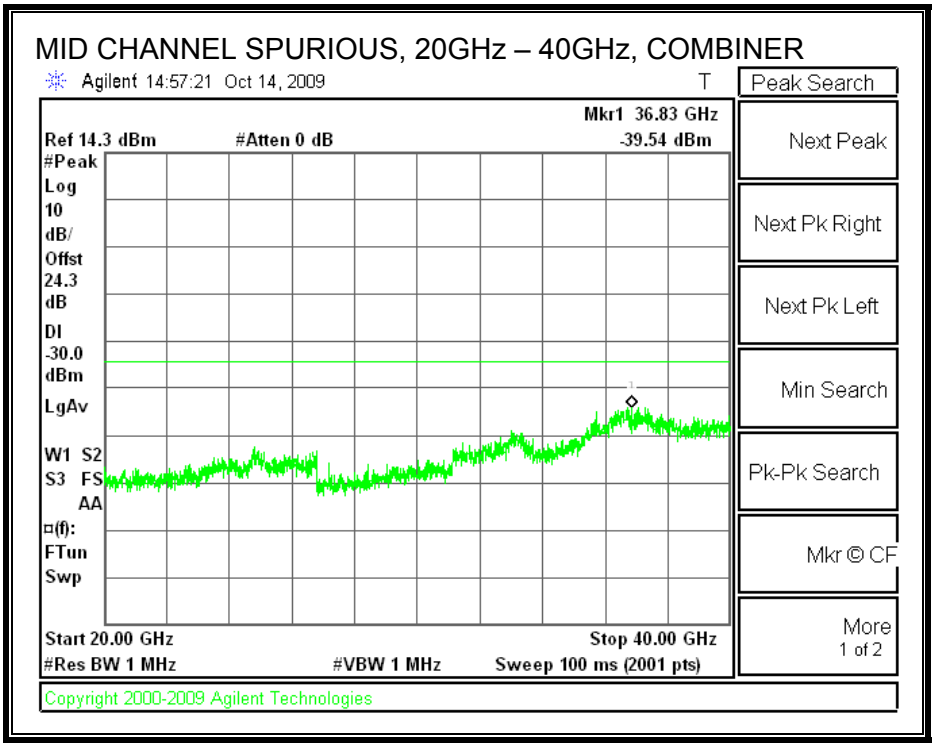
**LOW CHANNEL SPURIOUS EMISSIONS**



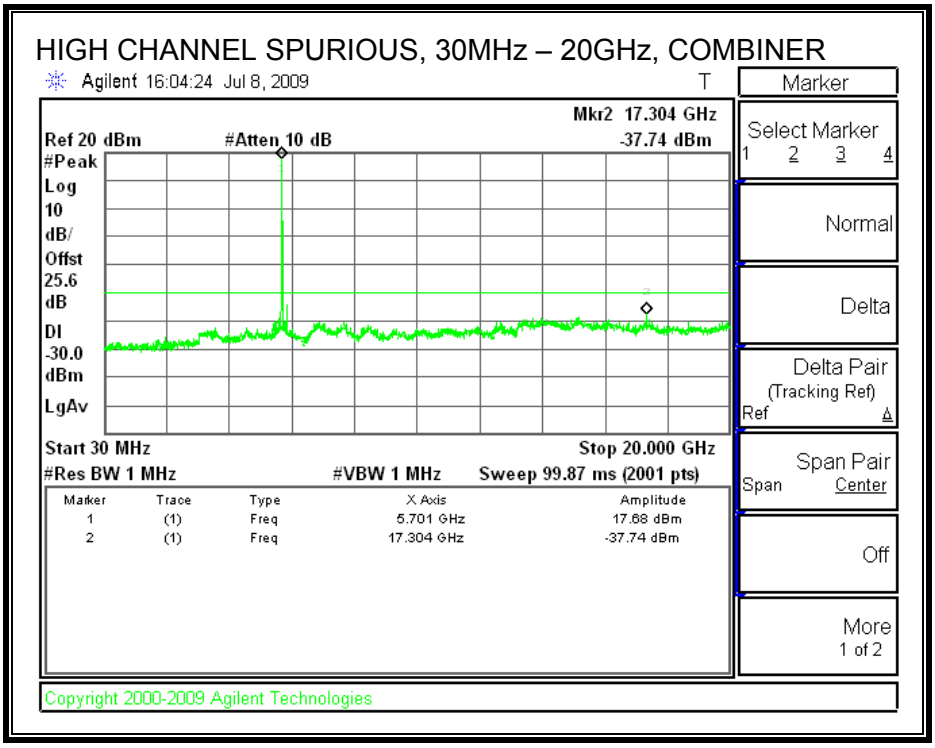



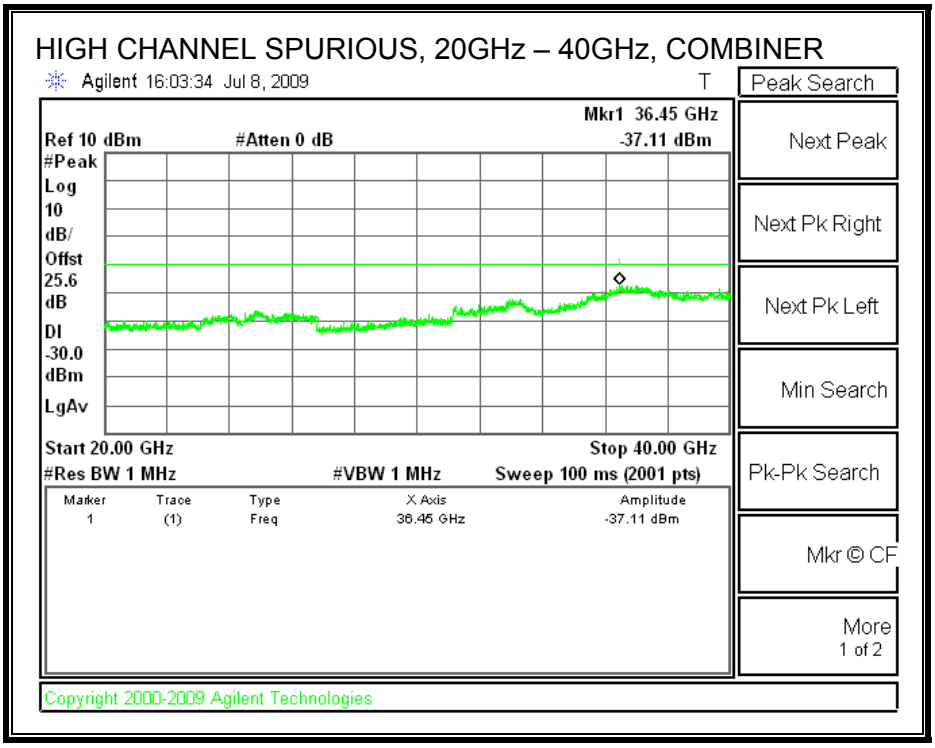
**MID CHANNEL SPURIOUS EMISSIONS**



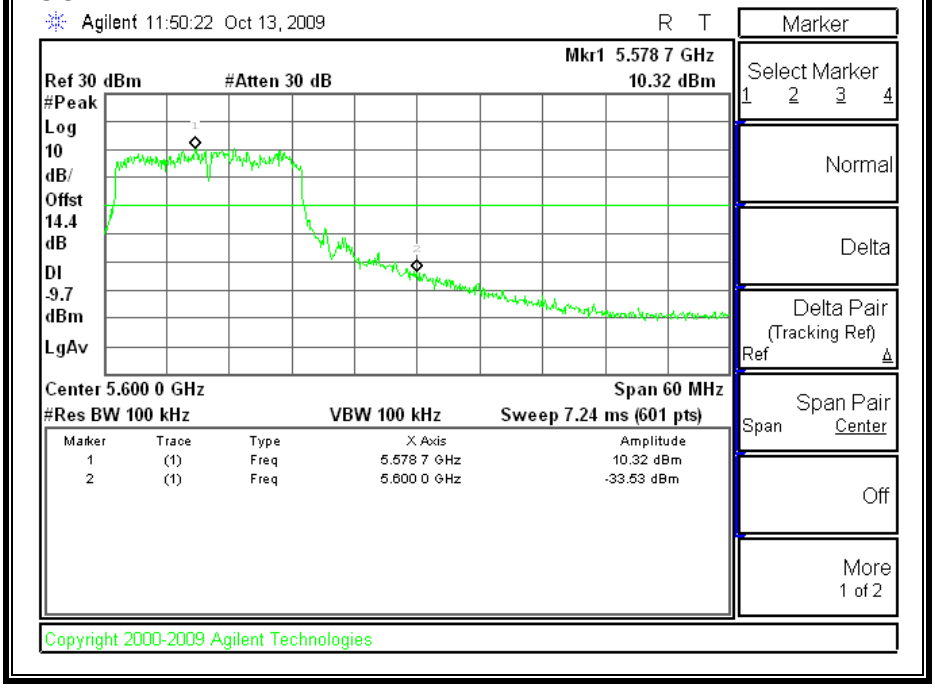
**HIGH CHANNEL SPURIOUS EMISSIONS**



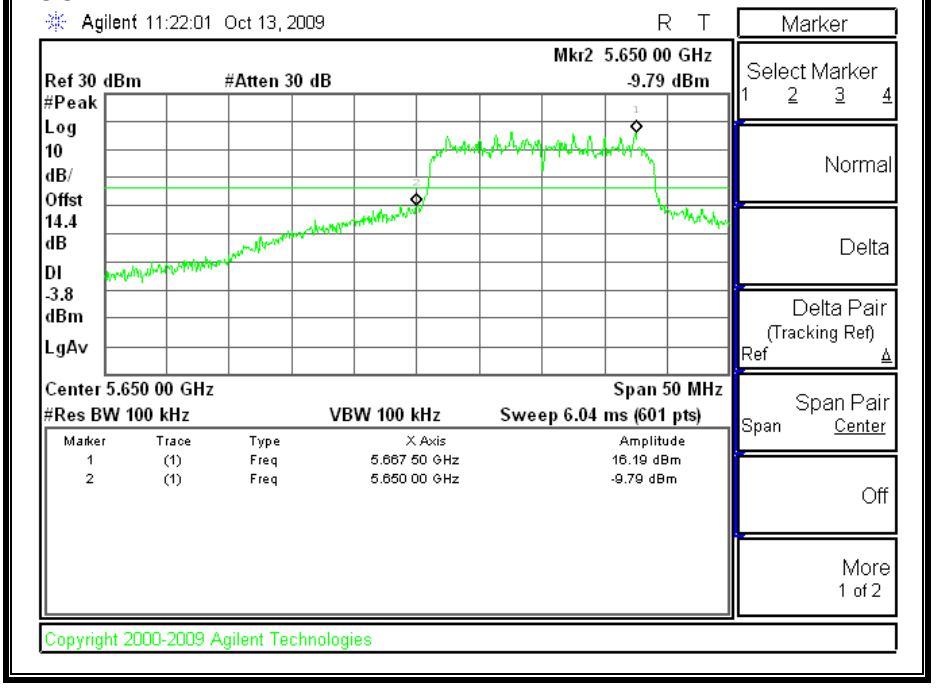



## 7.7.14. CONDUCTED SPURIOUS (-20 dBc)

LOW CHANNEL CONDUCTED SPURIOUS (-20 dBc) WITH COMBINER




HIGH CHANNEL CONDUCTED SPURIOUS (-20 dBc) WITH COMBINER



# 7.8. 5.6 GHz BAND CHANNEL TESTS FOR 802.11n HT40 MODE

## 7.8.1. 99% & 26 dB BANDWIDTH

**LIMITS**

None; for reporting purposes only.

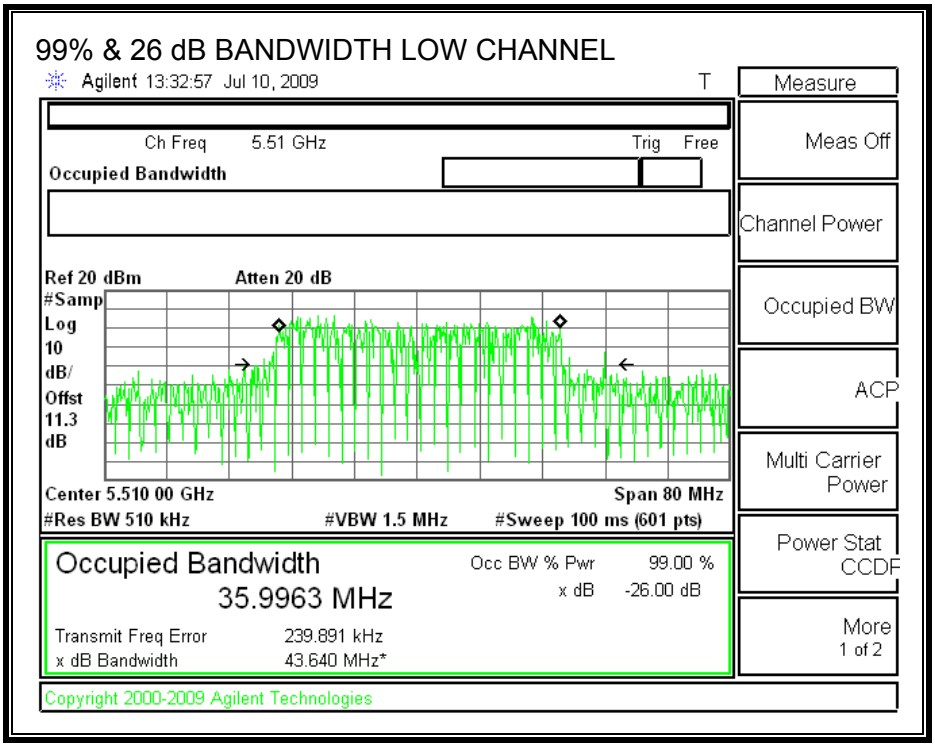
**TEST PROCEDURE**

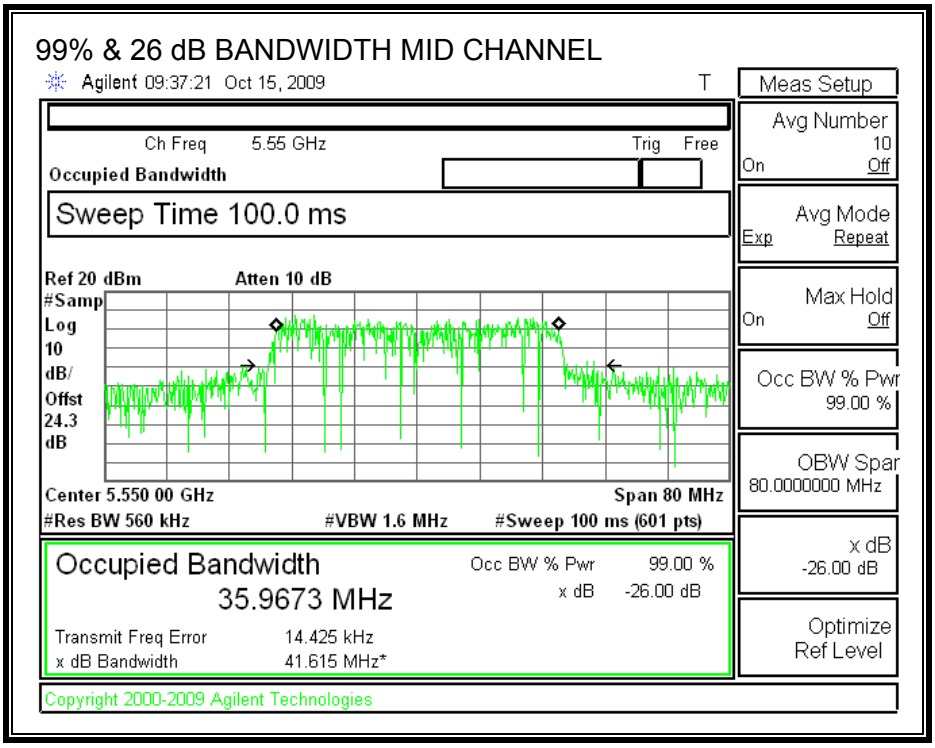
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth measurement function is utilized.

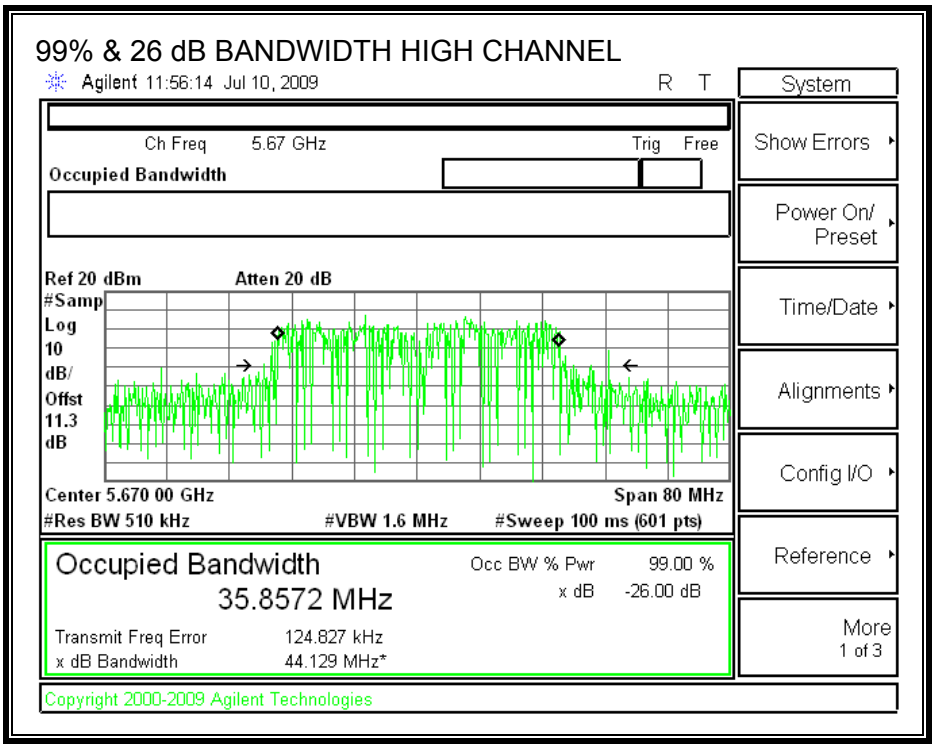
**RESULTS**

| Channel | Frequency (MHz) | 99% OBW (MHz) | 26 dB BW (MHz) |
|---|---|---|---|
| Low | 5510 | 35.9963 | 43.640 |
| Middle | 5550 | 35.9673 | 41.615 |
| High | 5670 | 35.8572 | 44.129 |

**99% & 26 dB BANDWIDTH**





## 7.8.2. OUTPUT POWER

**LIMITS**

FCC §15.407 (a) (2)
IC RSS-210 A9.2 (2)

For the 5.47-5.725 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**TEST PROCEDURE**

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.
The transmitter output operates continuously therefore Method # 1 is used.

**RESULTS**

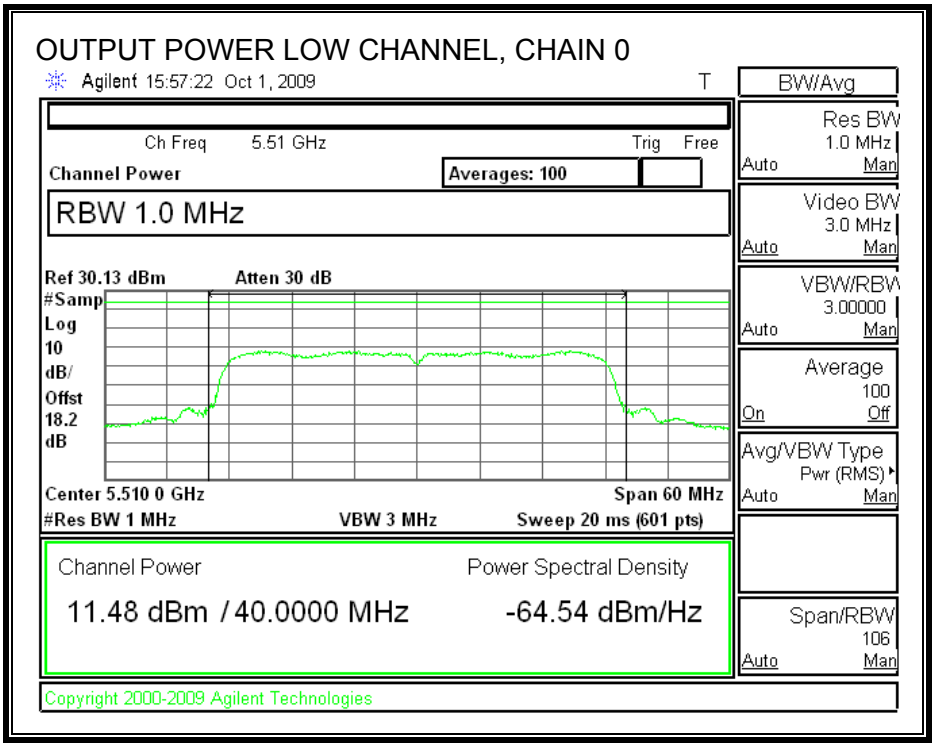
**Limit**

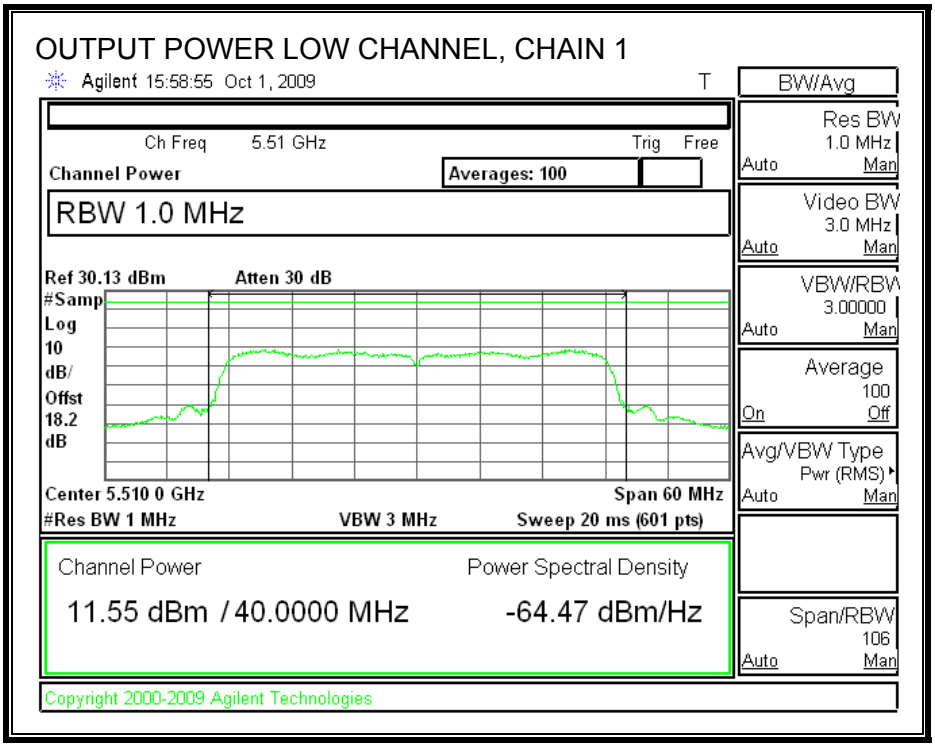
| Channel | Freq (MHz) | Fixed Limit (dBm) | B (MHz) | 11 + 10 Log B Limit (dBm) | Antenna Gain (dBi) | Limit (dBm) |
|---|---|---|---|---|---|---|
| Low | 5510 | 24 | 43.640 | 27.40 | 3 | 24.00 |
| Mid | 5550 | 24 | 41.615 | 27.19 | 3 | 24.00 |
| High | 5670 | 24 | 44.129 | 27.45 | 3 | 24.00 |

**Individual Chain Results**

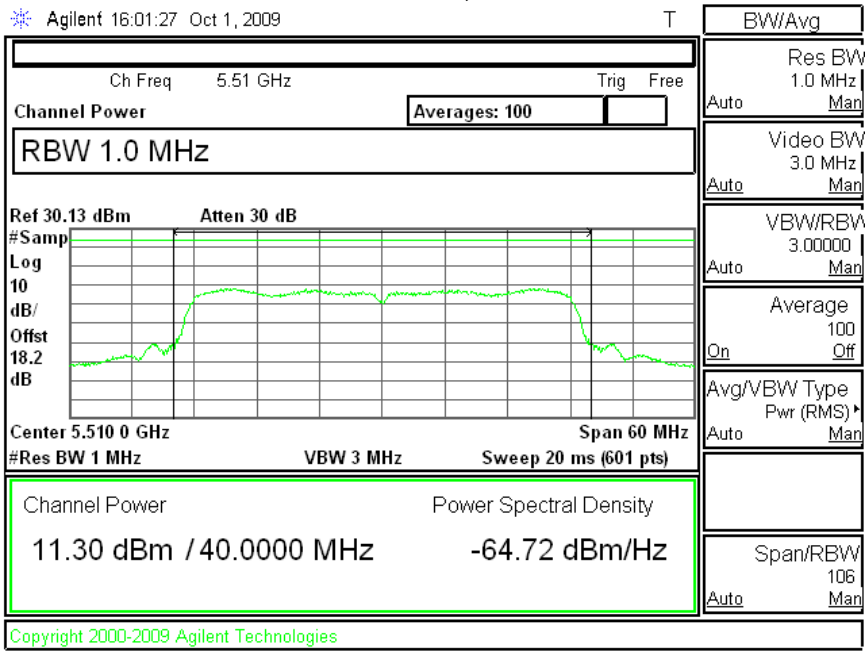
| Channel | Freq (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Chain 3 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| Low | 5510 | 11.48 | 11.55 | 11.30 | 11.63 | 17.51 | 24.00 | -6.49 |
| Mid | 5550 | 17.53 | 18.01 | 17.80 | 17.76 | 23.80 | 24.00 | -0.20 |
| High | 5670 | 14.49 | 14.29 | 14.19 | 13.95 | 20.25 | 24.00 | -3.75 |

**OUTPUT POWER, LOW CHANNEL**

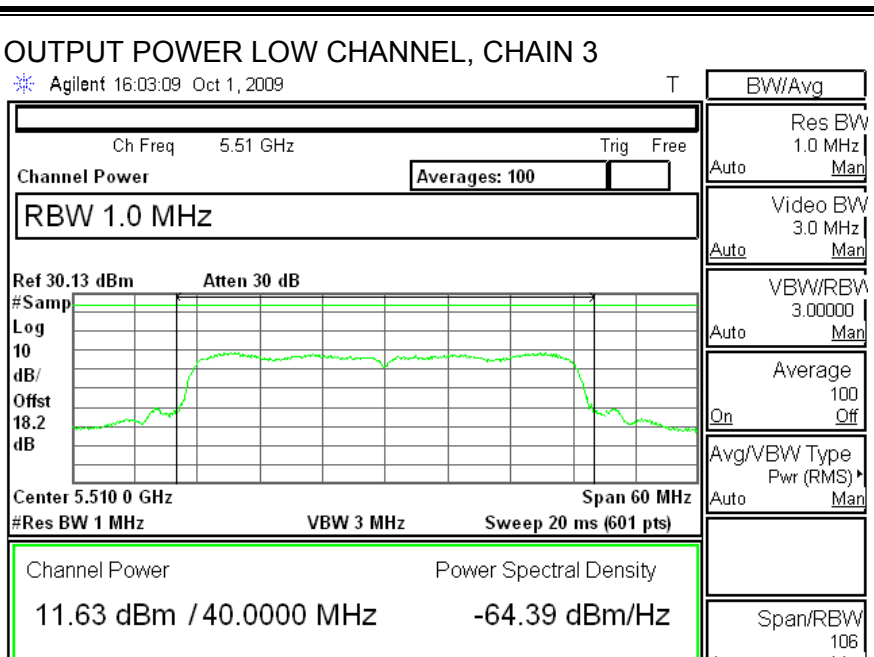


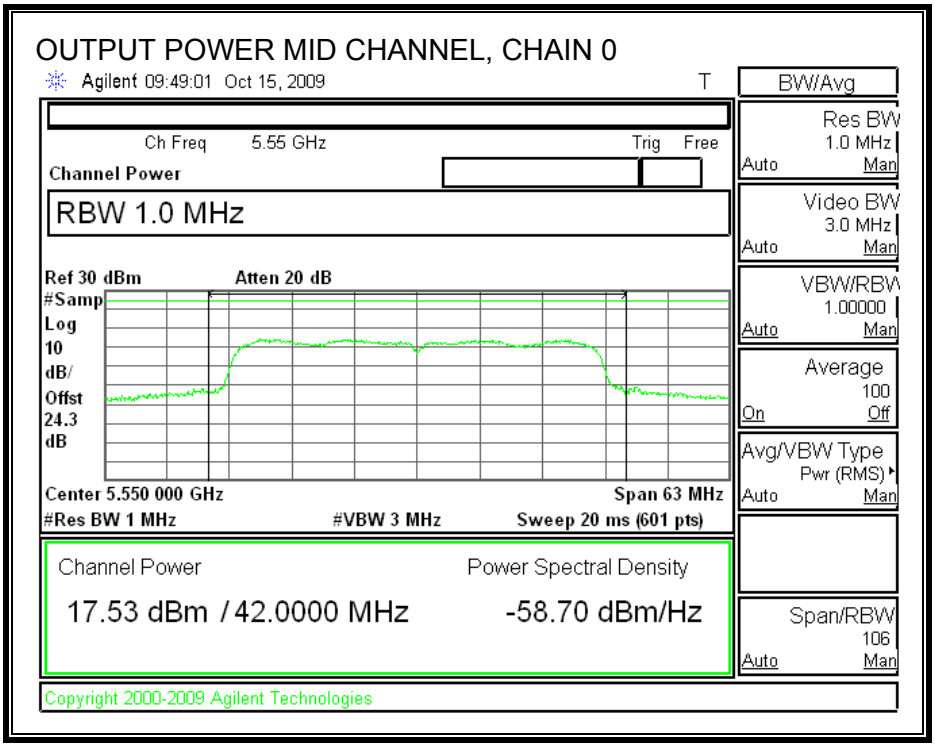
OUTPUT POWER LOW CHANNEL, CHAIN 2

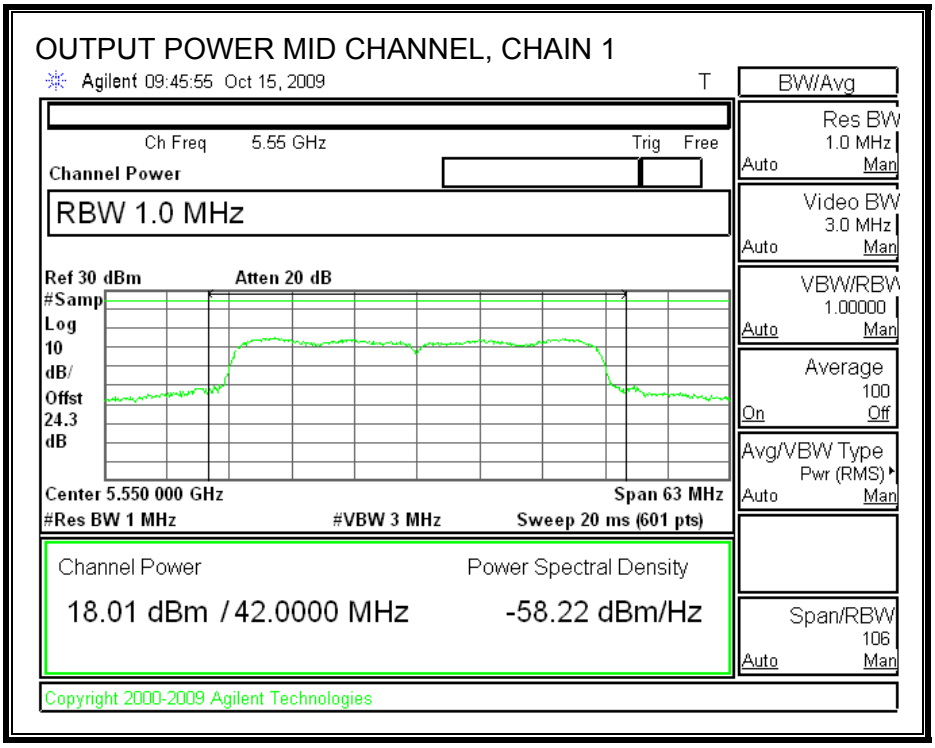



OUTPUT POWER LOW CHANNEL, CHAIN 3

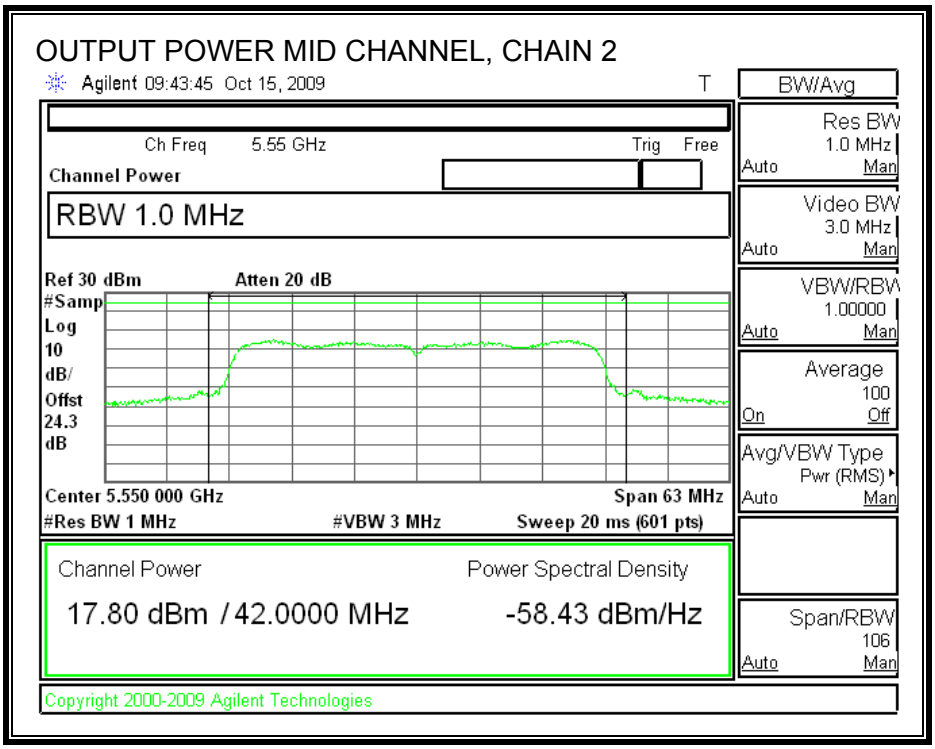


**OUTPUT POWER, MID CHANNEL**

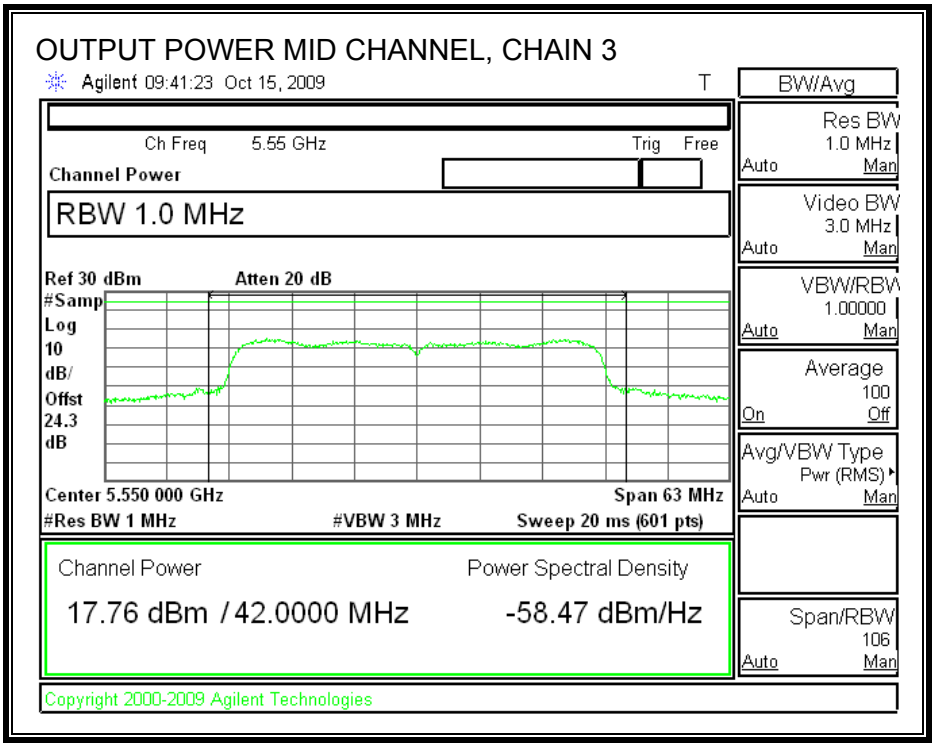


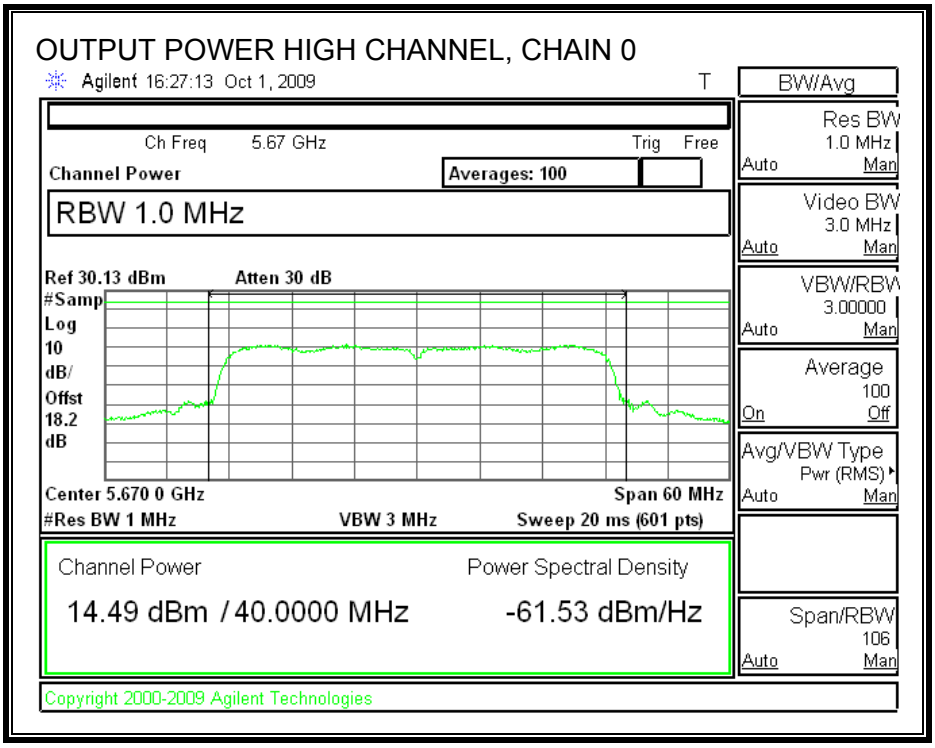
OUTPUT POWER MID CHANNEL, CHAIN 2

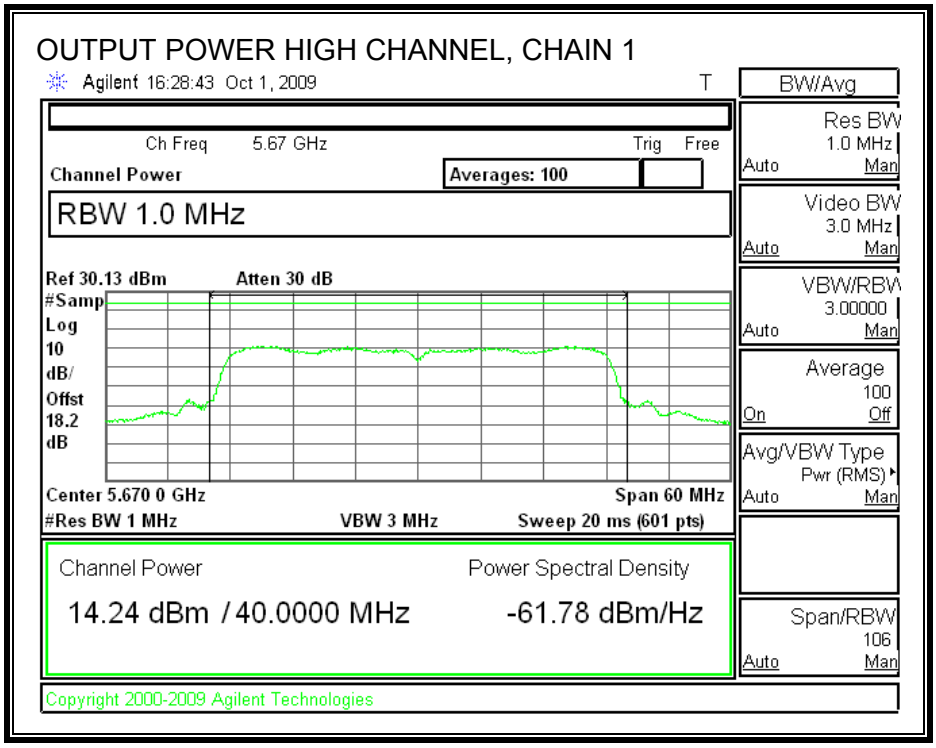



OUTPUT POWER MID CHANNEL, CHAIN 3

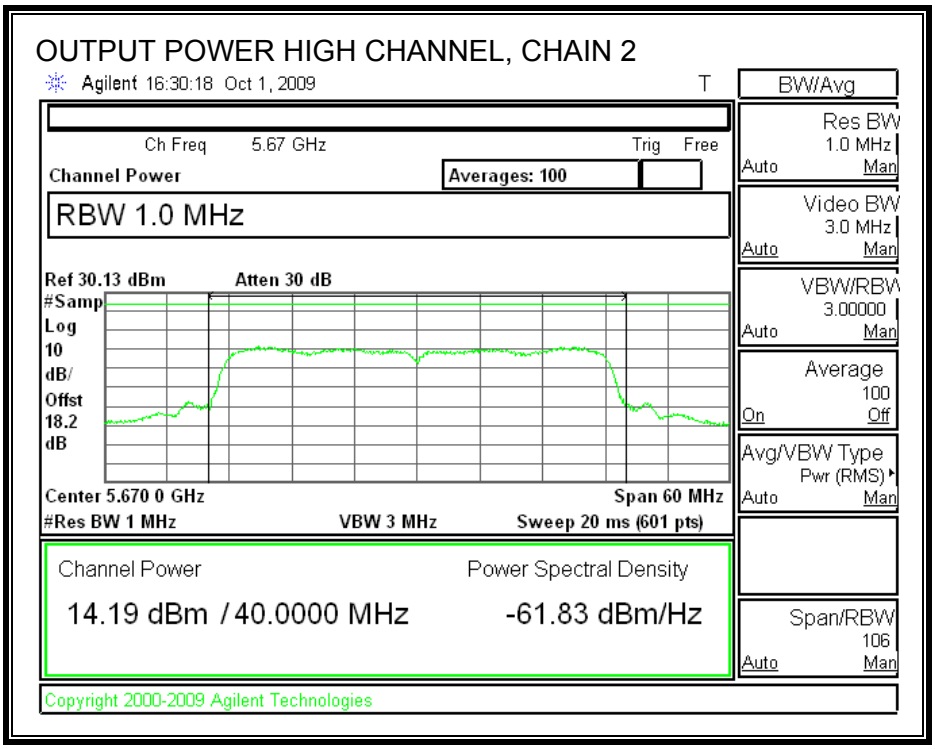


**OUTPUT POWER, HIGH CHANNEL**

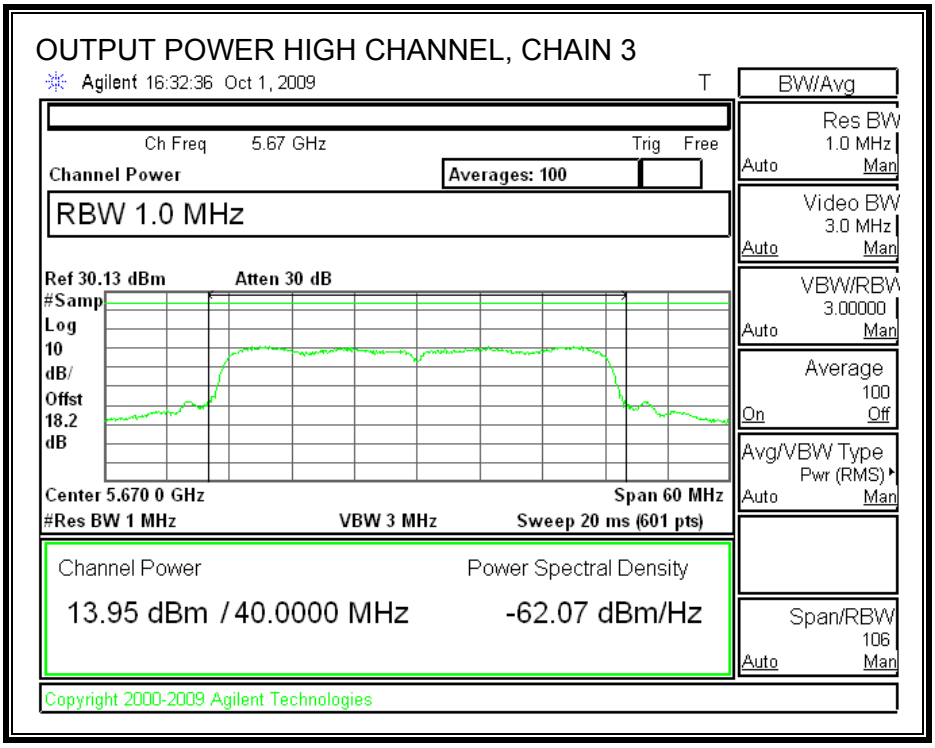


OUTPUT POWER HIGH CHANNEL, CHAIN 2




OUTPUT POWER HIGH CHANNEL, CHAIN 3



## 7.8.3. AVERAGE POWER

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.3 dB (including 10 dB pad and 1.3 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

**RESULTS**

| Channel | Frequency (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Chain 3 Power (dBm) |
|---|---|---|---|---|---|
| Low | 5510 | 11.44 | 11.53 | 11.30 | 11.51 |
| Middle | 5550 | 17.39 | 17.83 | 17.61 | 17.59 |
| High | 5670 | 14.45 | 14.21 | 14.15 | 13.92 |

## 7.8.4. PEAK POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.47-5.725 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 11 dBm.

**TEST PROCEDURE**

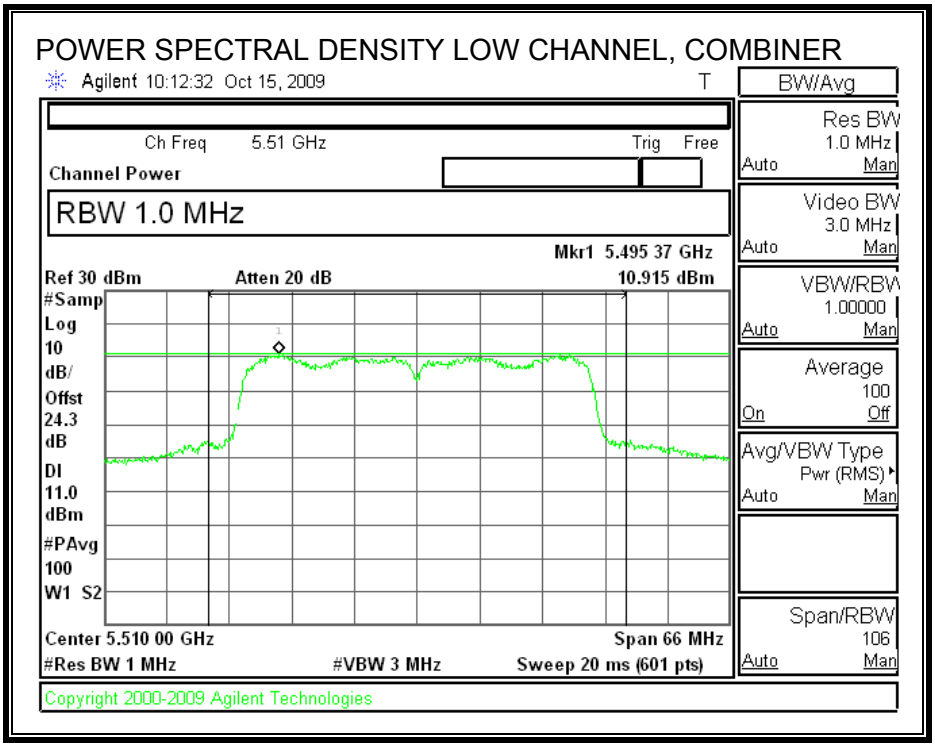
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

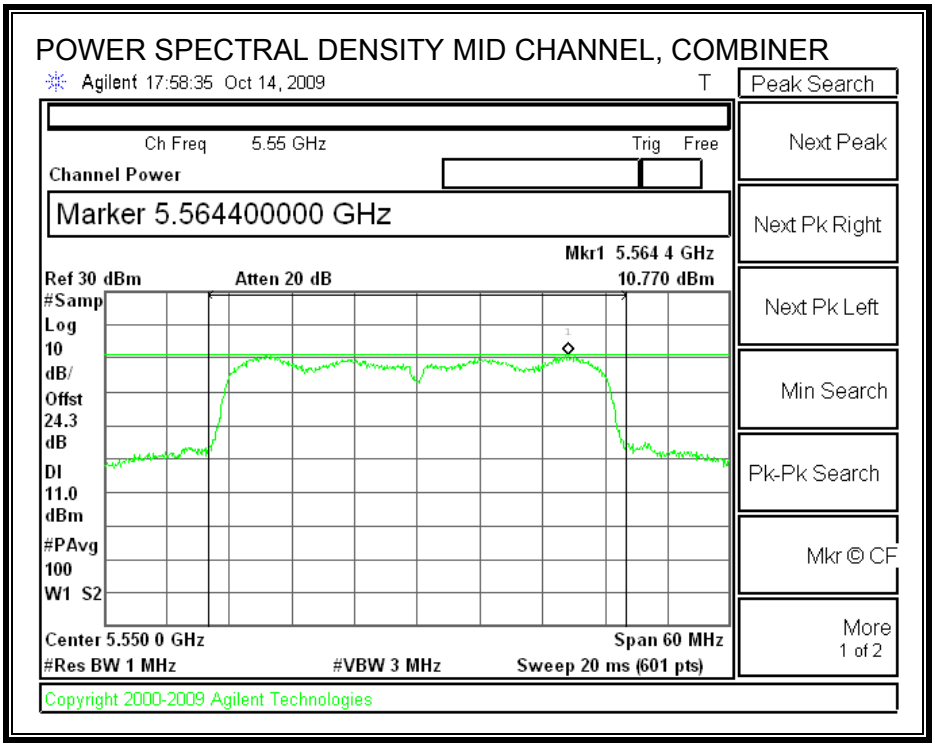
Preliminary tests on individual chains, and on all chains with a combiner, were performed. The worst-case configuration was with a combiner, therefore final test were performed with all chains feeding a combiner.

**RESULTS**

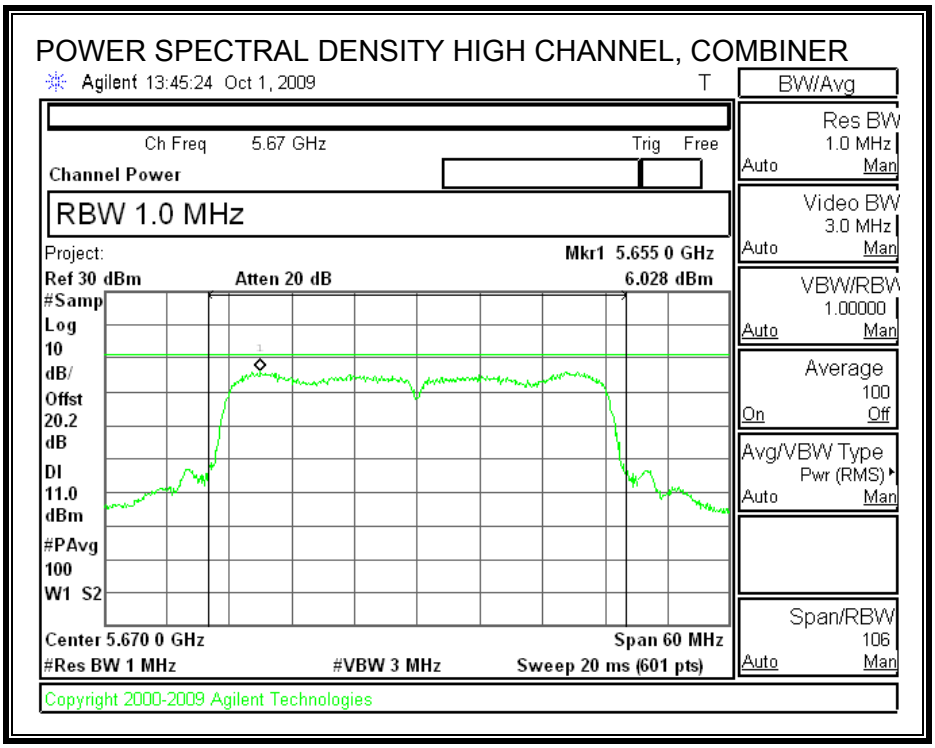
| Channel | Frequency (MHz) | PSD with Combiner (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 5510 | 10.915 | 11 | -0.09 |
| Middle | 5550 | 10.770 | 11 | -0.23 |
| High | 5670 | 6.028 | 11 | -4.97 |

**POWER SPECTRAL DENSITY**



POWER SPECTRAL DENSITY HIGH CHANNEL, COMBINER



## 7.8.5. PEAK EXCURSION

**LIMITS**

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

**TEST PROCEDURE**

The transmitter outputs are connected to the spectrum analyzer via a combiner.

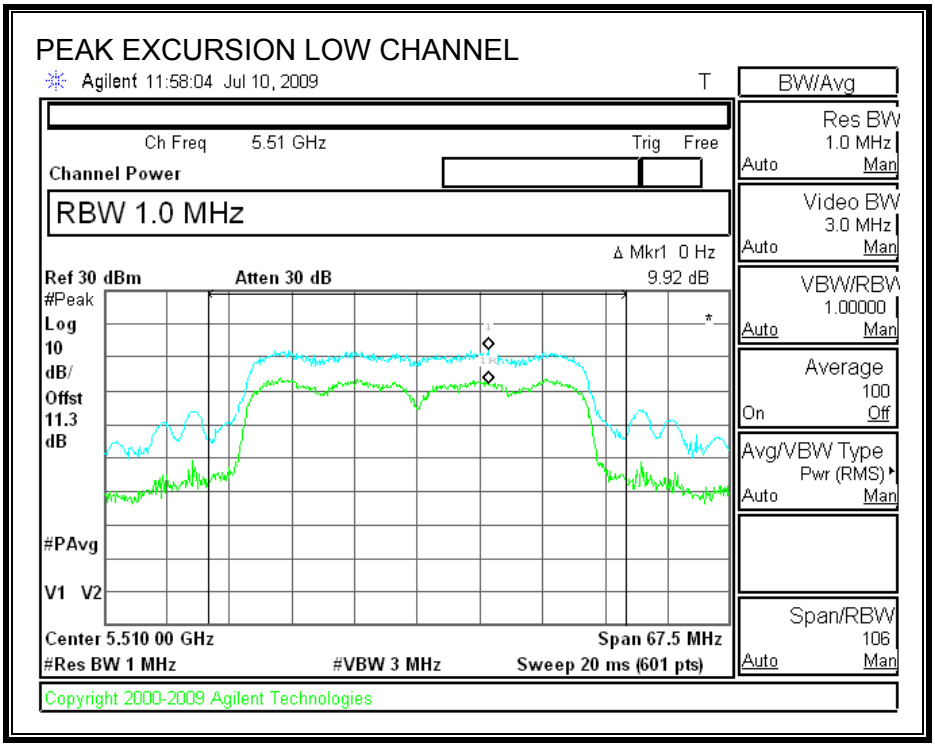
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

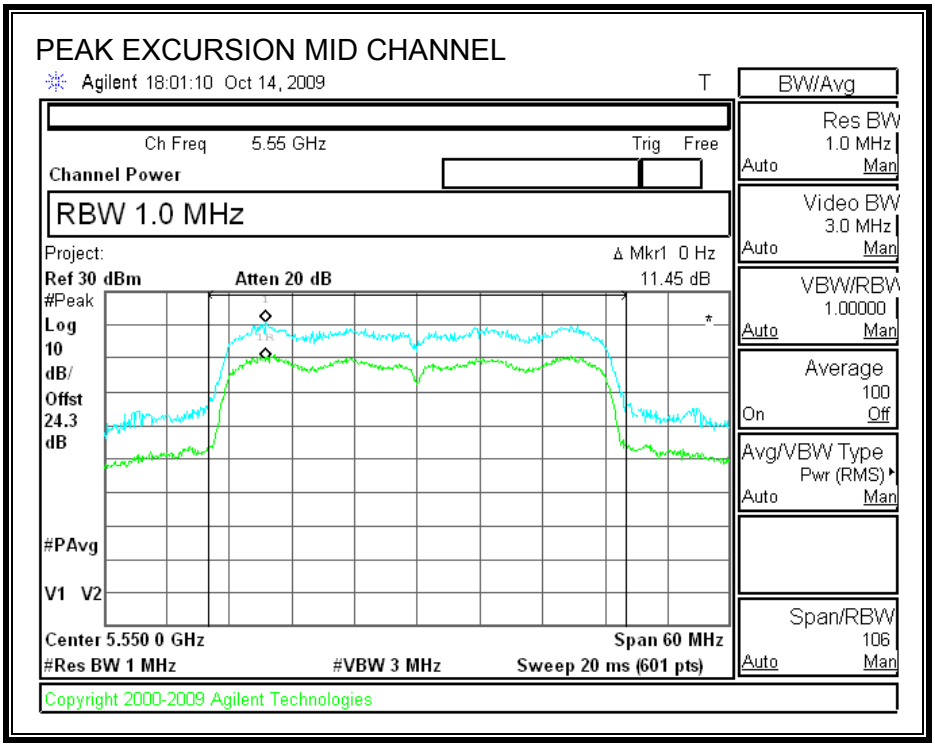
Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

**RESULTS**

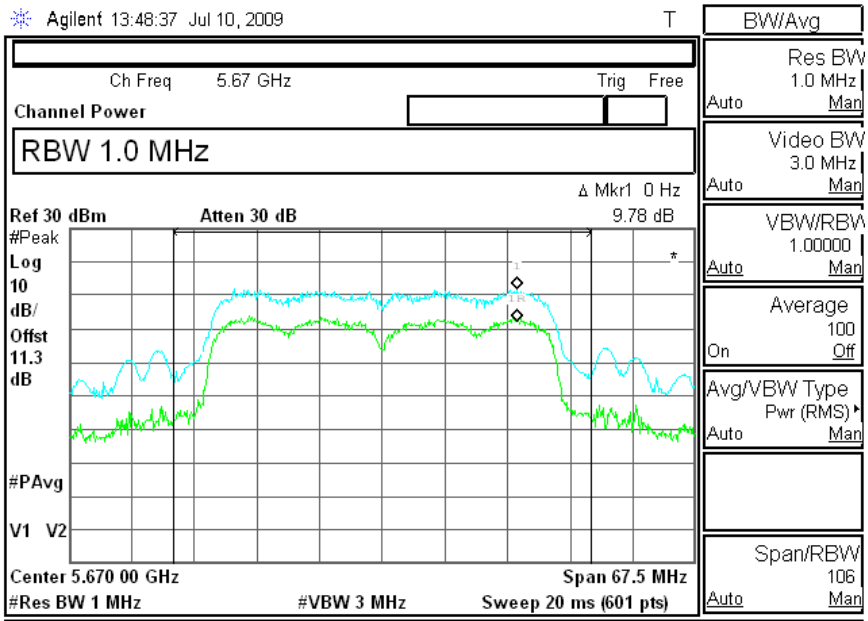
| Channel | Frequency (MHz) | Peak Excursion (dB) | Limit (dB) | Margin (dB) |
|---|---|---|---|---|
| Low | 5510 | 9.92 | 13 | -3.08 |
| Middle | 5550 | 11.45 | 13 | -1.55 |
| High | 5670 | 9.78 | 13 | -3.22 |

**PEAK EXCURSION**



PEAK EXCURSION HIGH CHANNEL



## 7.8.6. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.407 (b) (3)

IC RSS-210 A9.3 (3)

For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm / MHz.

**TEST PROCEDURE**

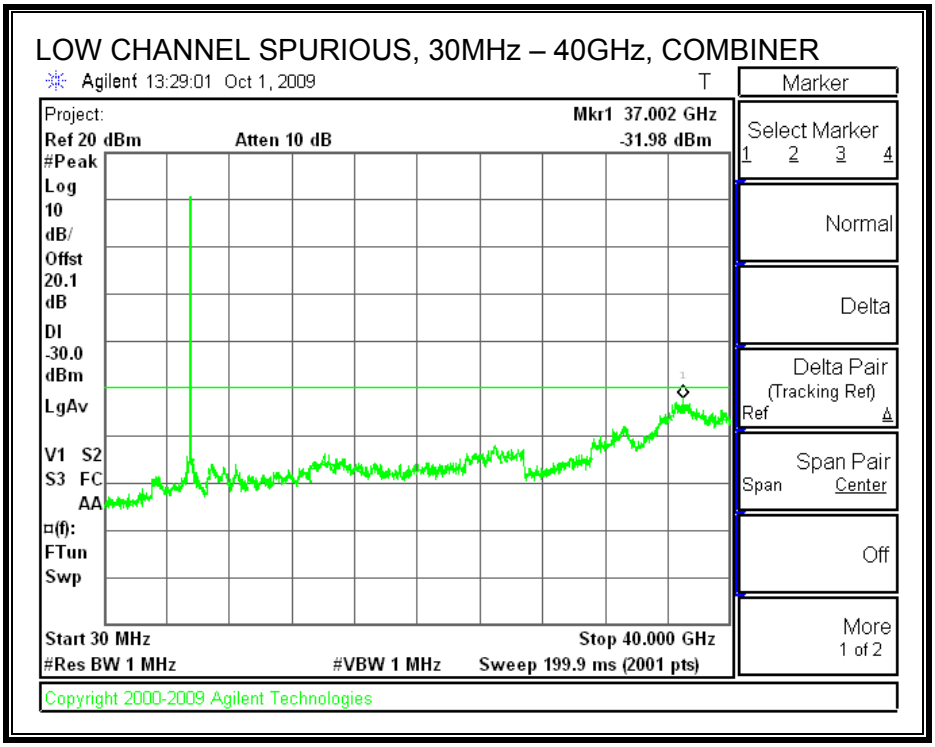
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

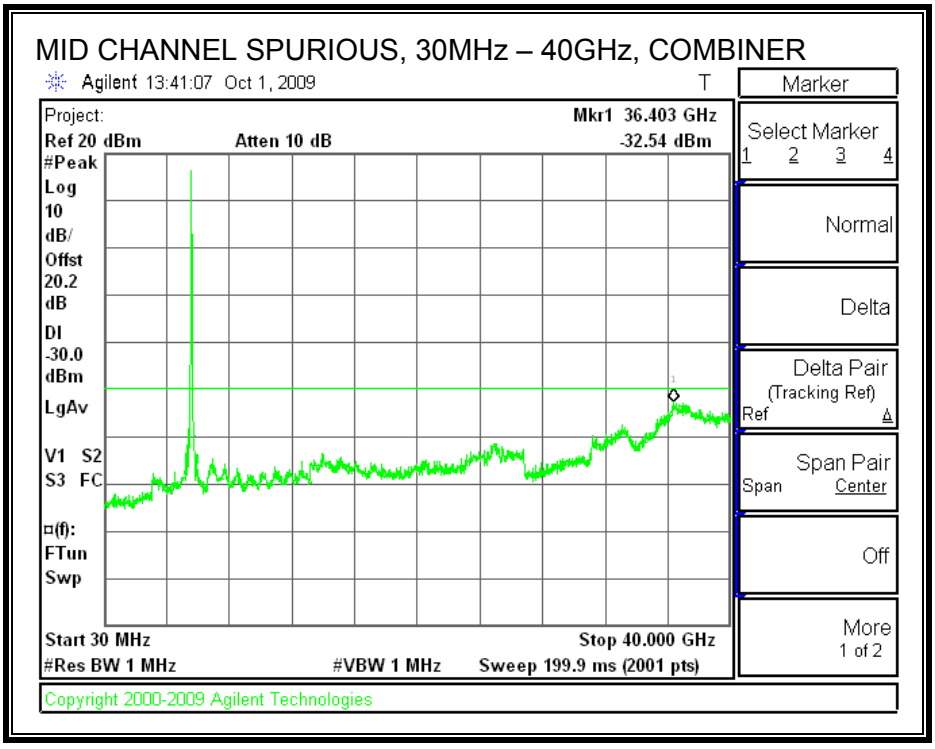
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

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

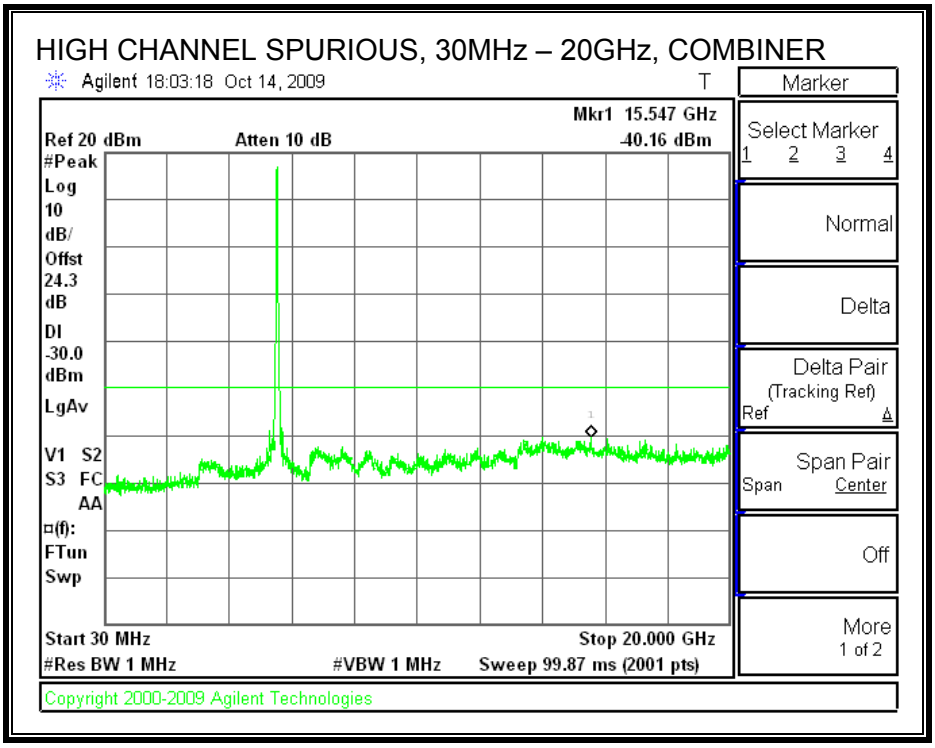
**LOW CHANNEL SPURIOUS EMISSIONS**

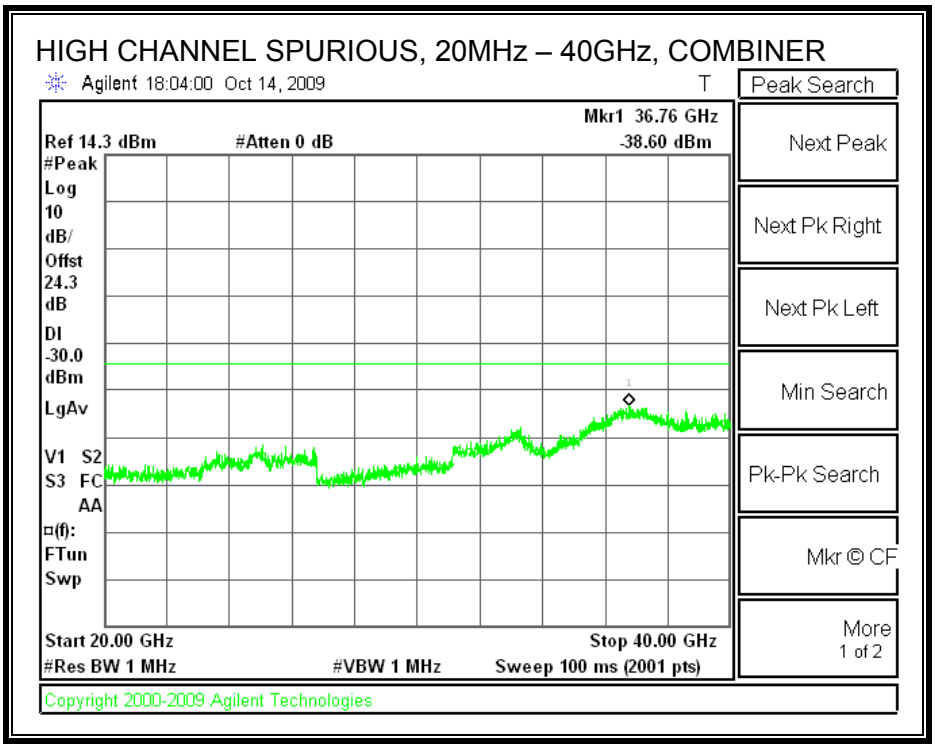



**MID CHANNEL SPURIOUS EMISSIONS**



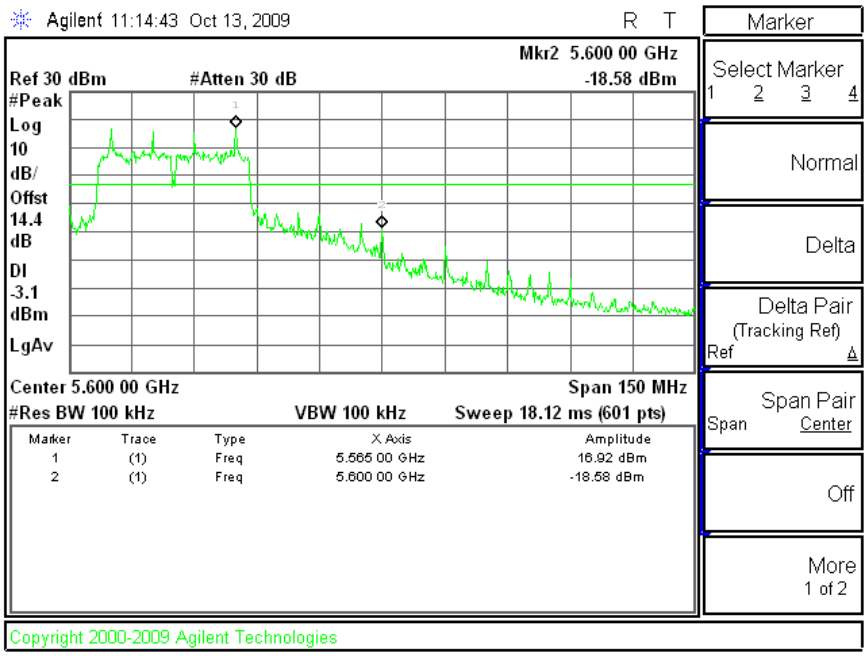
**HIGH CHANNEL SPURIOUS EMISSIONS**



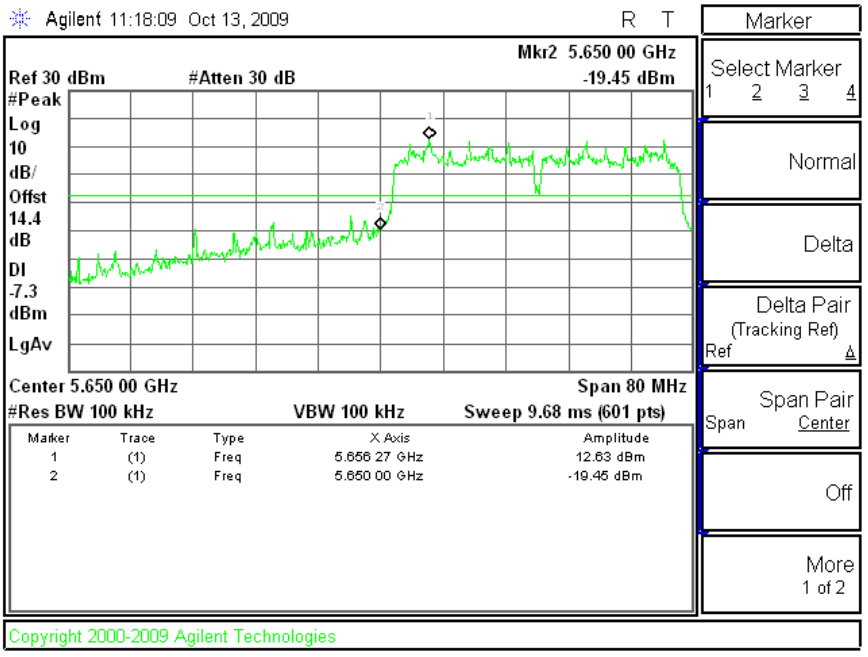



## 7.8.7. CONDUCTED SPURIOUS (-20 dBc)

LOW CHANNEL CONDUCTED SPURIOUS (-20 dBc) WITH COMBINER




HIGH CHANNEL CONDUCTED SPURIOUS (-20 dBc) WITH COMBINER



## 7.9. RECEIVER CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

IC RSS-GEN 7.2.3.1

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

**TEST PROCEDURE**

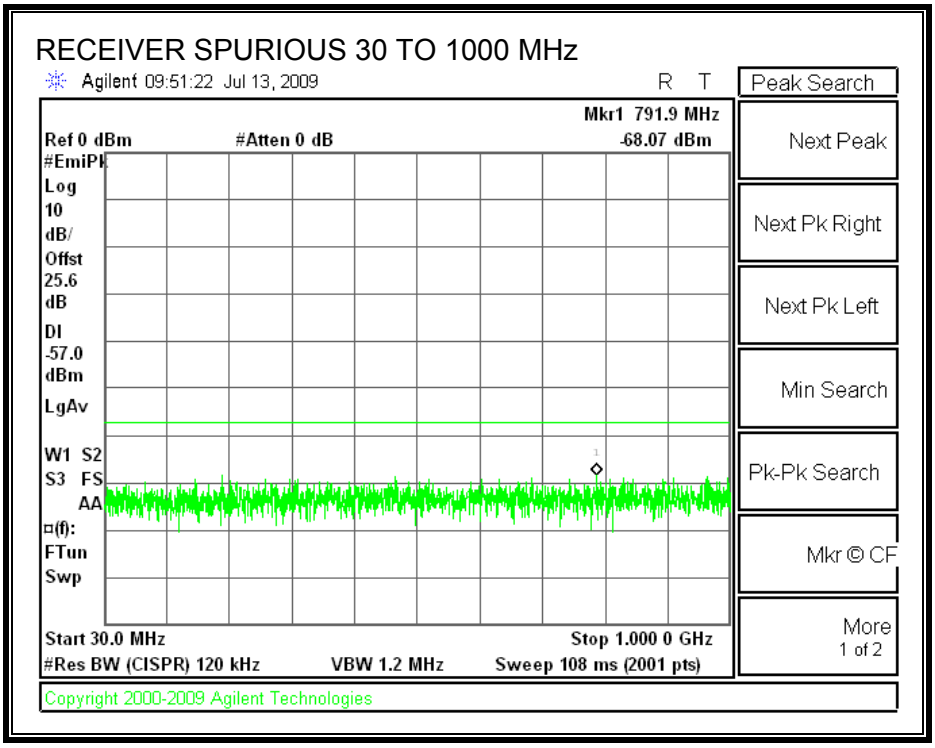
IC RSS-GEN 4.10, Conducted Method

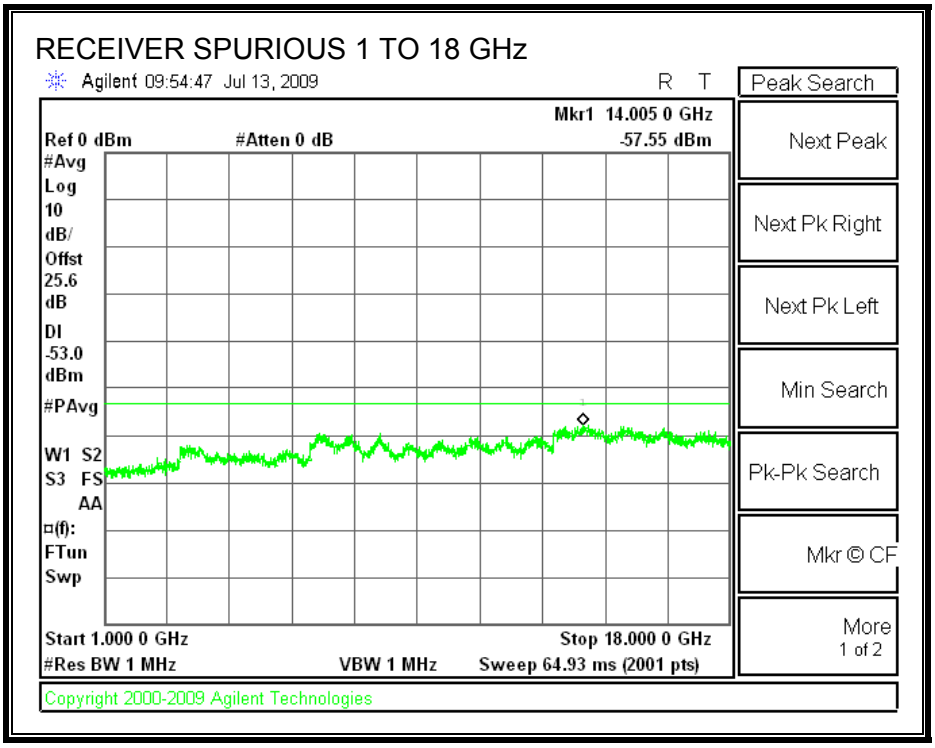
The receiver antenna port is connected to a spectrum analyzer.

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

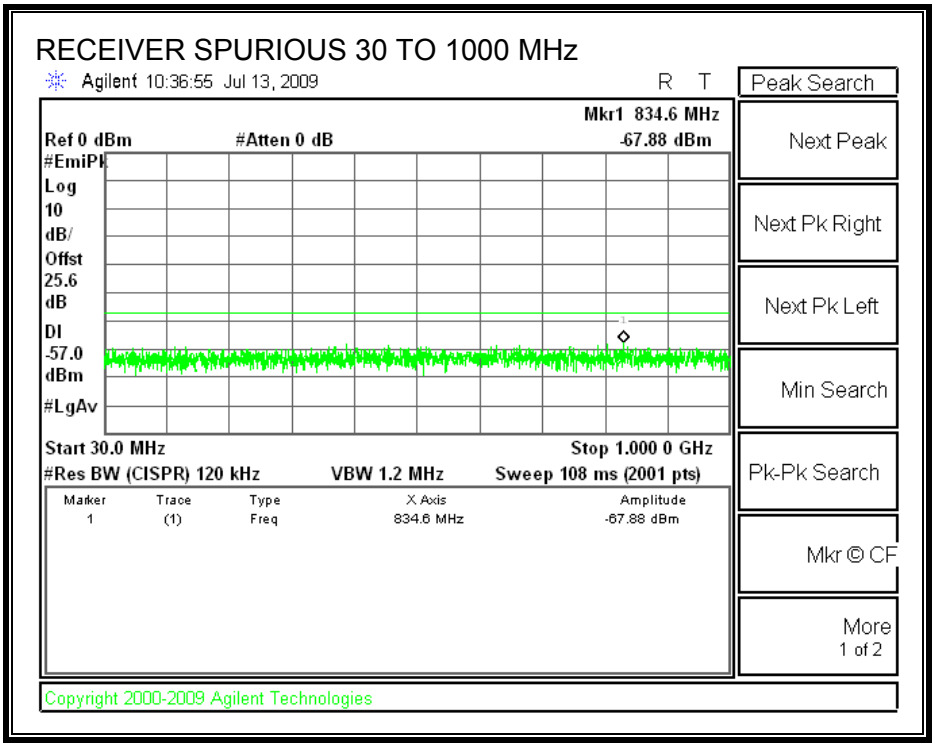
Preliminary tests on individual chains, and on all chains with a combiner, were performed. The worst-case configuration was with a combiner, therefore final test were performed with all chains feeding a combiner.

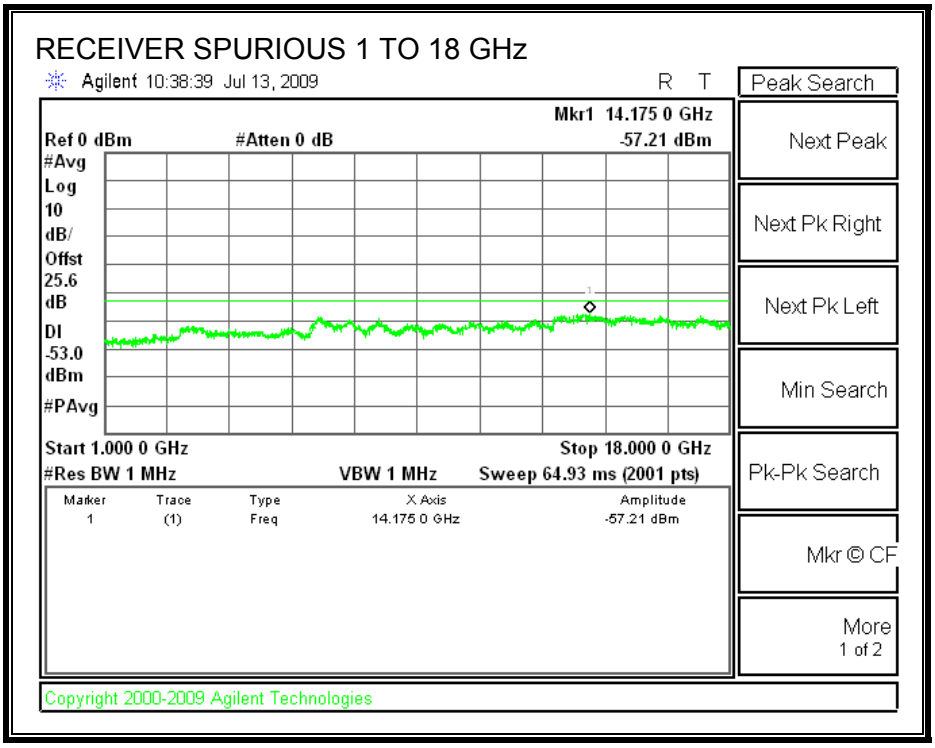
**RECEIVER SPURIOUS EMISSIONS IN THE 5.2 GHz BAND**



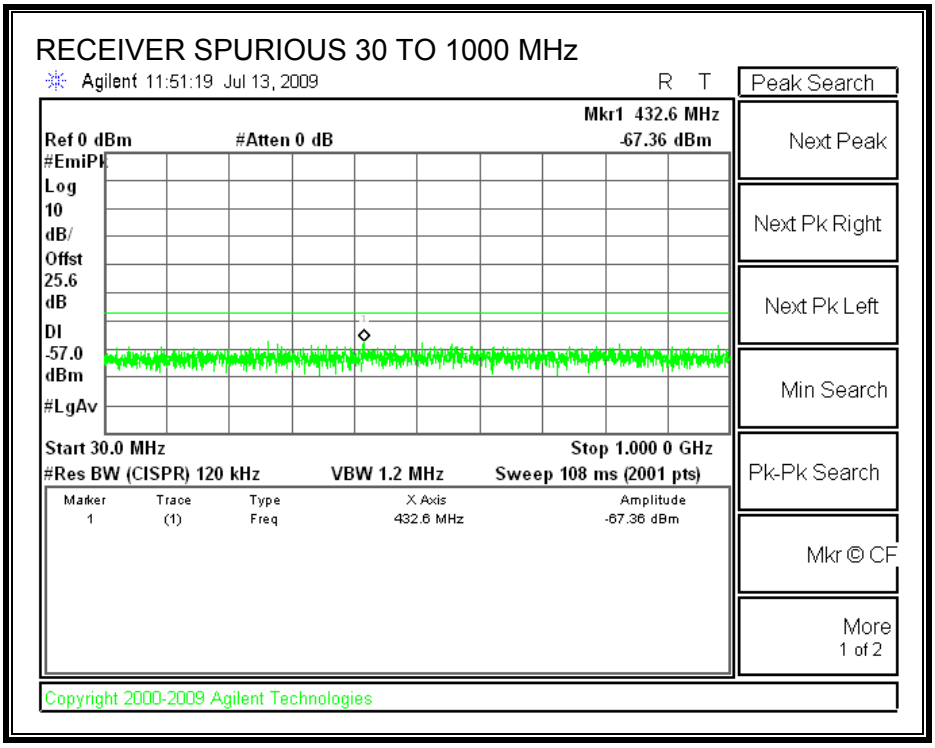



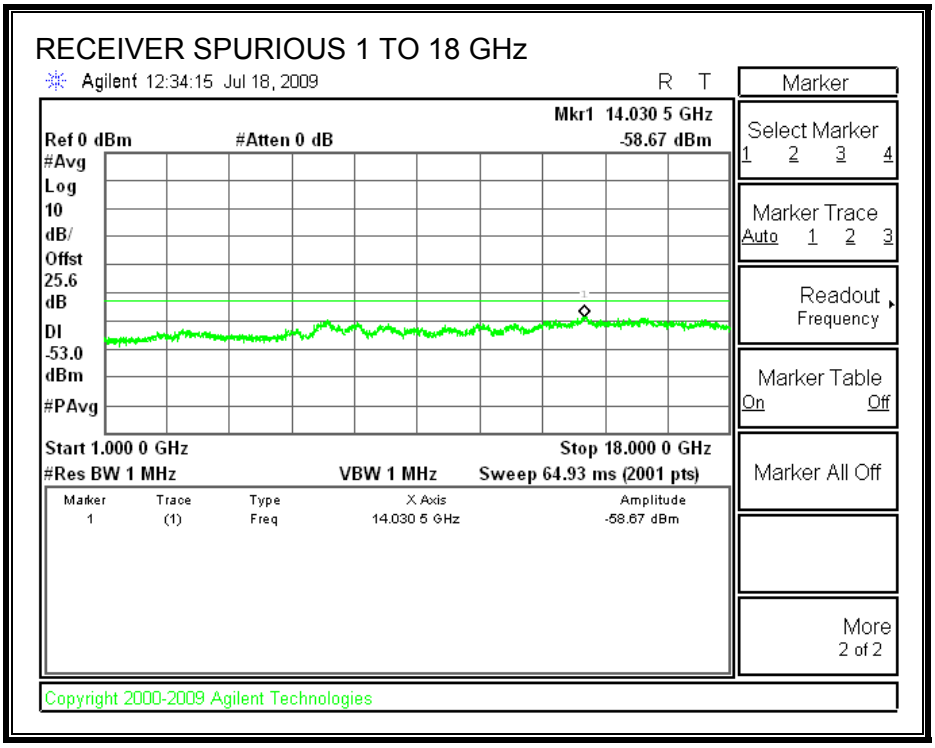
**RECEIVER SPURIOUS EMISSIONS IN THE 5.3 GHz BAND**



**RECEIVER SPURIOUS EMISSIONS IN THE 5.5 GHz BAND**



# 8. RADIATED TEST RESULTS

## 8.1. LIMITS AND PROCEDURE

**LIMITS**

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

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

**TEST PROCEDURE**

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

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

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

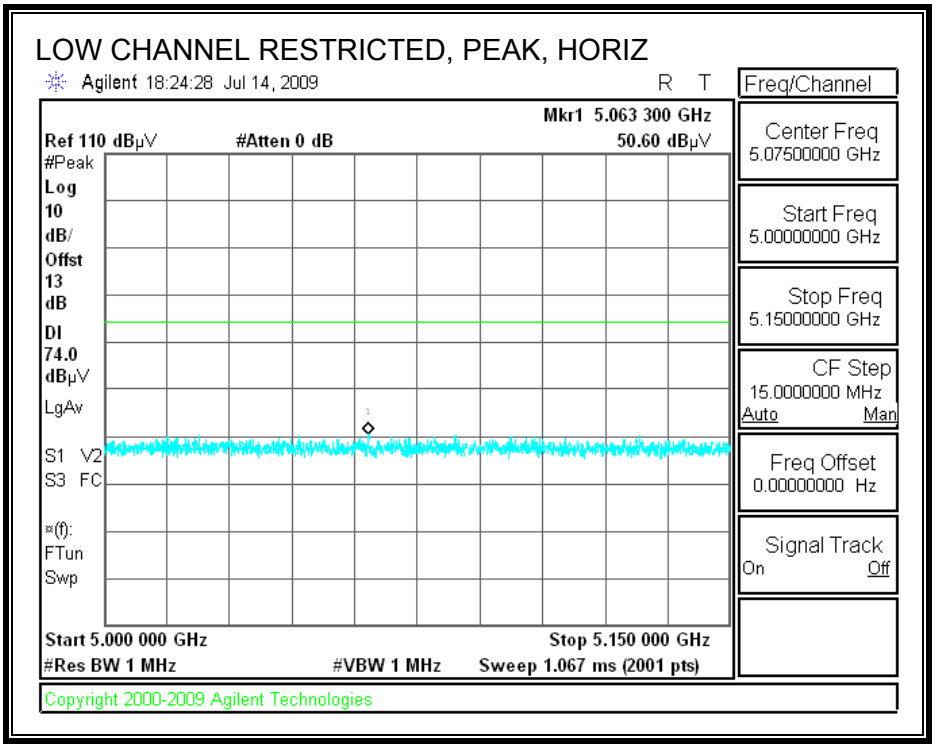
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

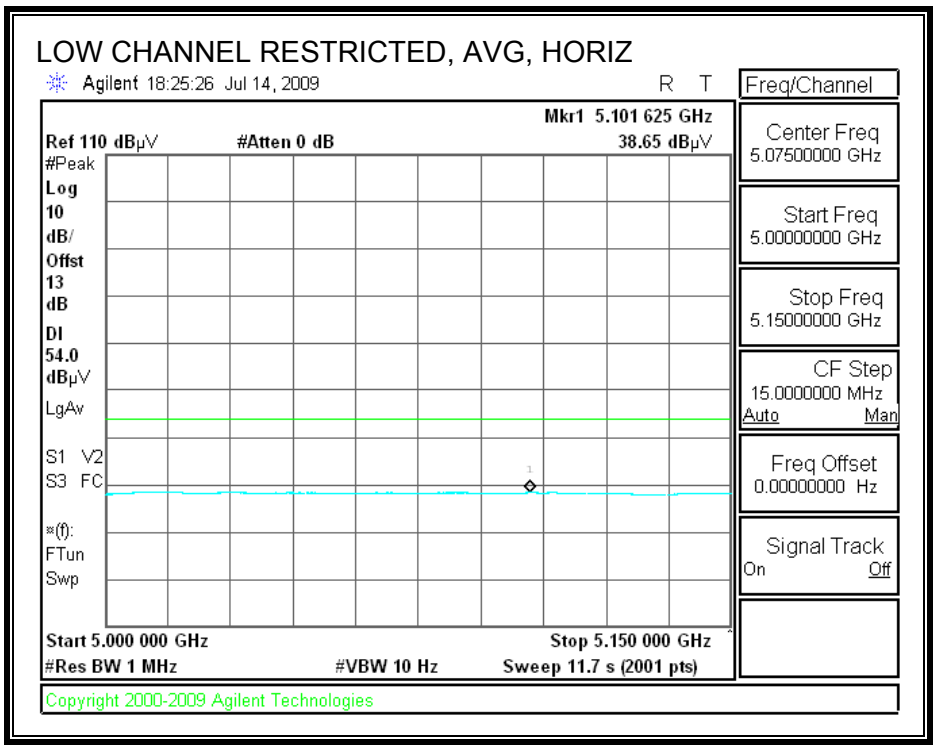
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

# 8.2. TRANSMITTER ABOVE 1 GHz

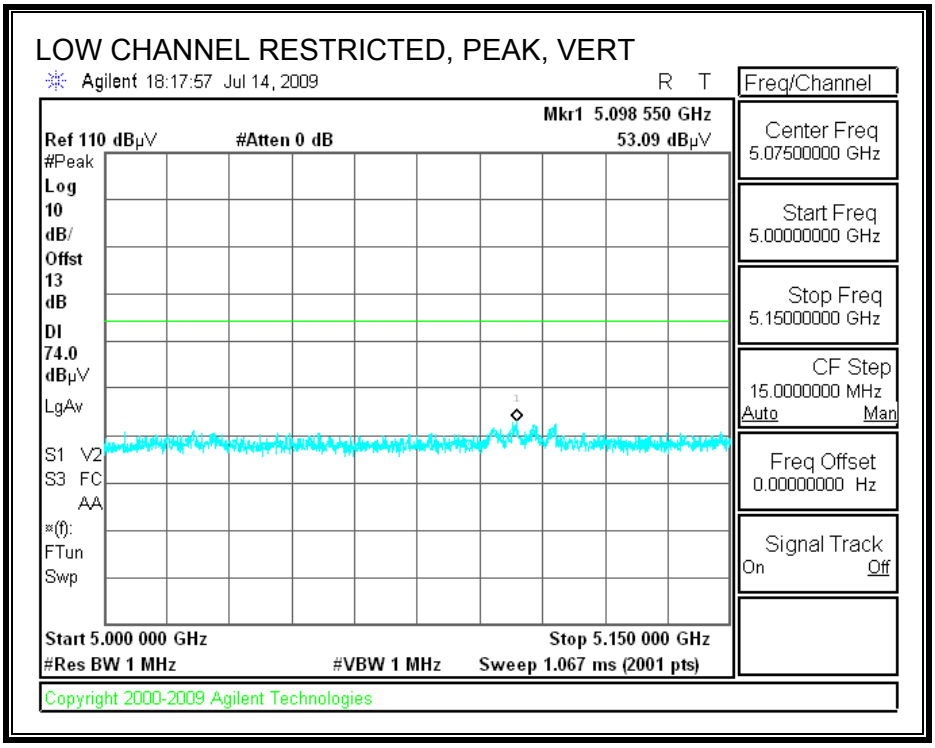
## 8.2.1. 802.11a MODE IN 5.2 GHz BAND

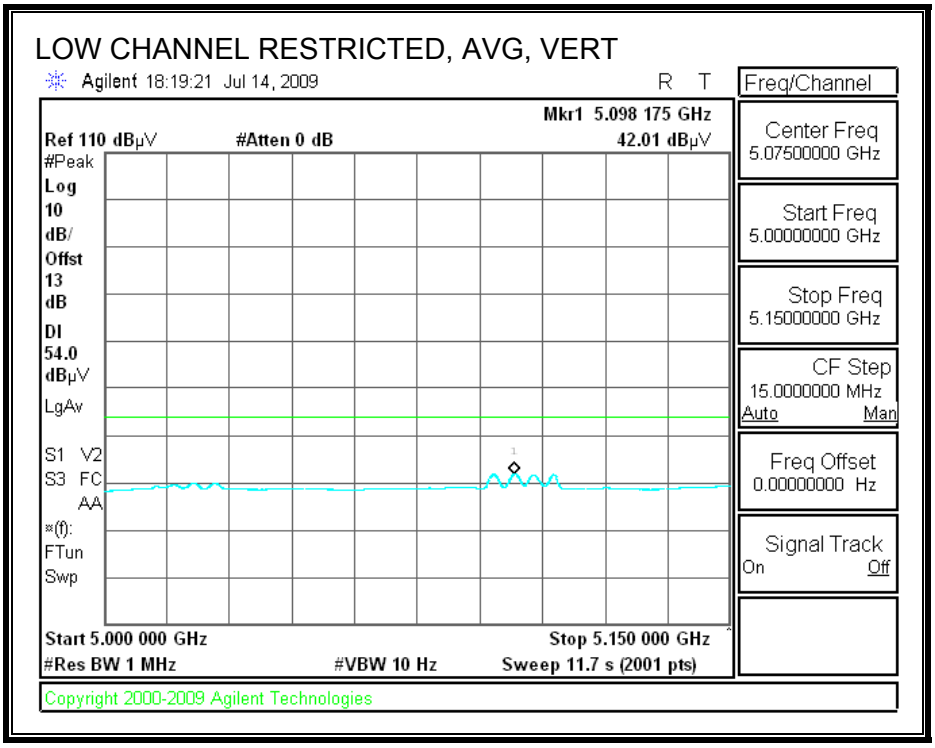
**RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)**



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



## HARMONICS AND SPURIOUS EMISSIONS

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

| | |
|---|---|
| **Test Engr:** | **Thanh Nguyen** |
| **Date:** | **07/14/09** |
| **Project #:** | **09U12652** |
| **Company:** | **QualComm** |
| **EUT Description:** | **5000 Series PCI Card** |
| **EUT M/N:** | **65-VN780-P2** |
| **Test Target:** | **FCC 15.247/15.407** |
| **Mode Oper:** | |

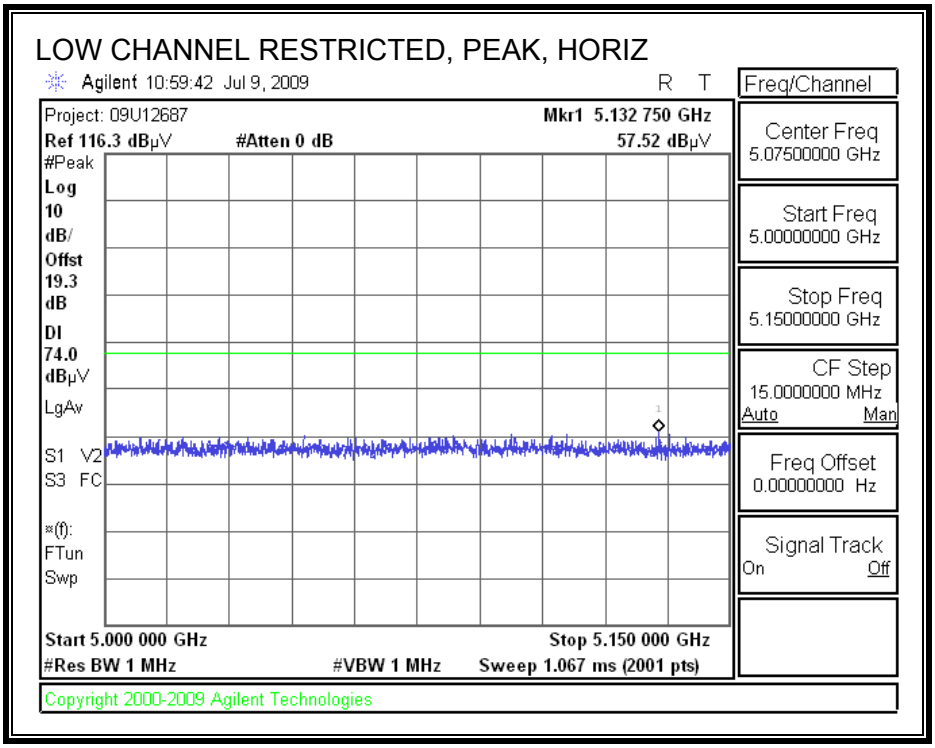
| | | | | | |
|---|---|---|---|---|---|
| f | Measurement Frequency | Amp | Preamp Gain | | Average Field Strength Limit |
| Dist | Distance to Antenna | D Corr | Distance Correct to 3 meters | | Peak Field Strength Limit |
| Read | Analyzer Reading | Avg | Average Field Strength @ 3 m | | Margin vs.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

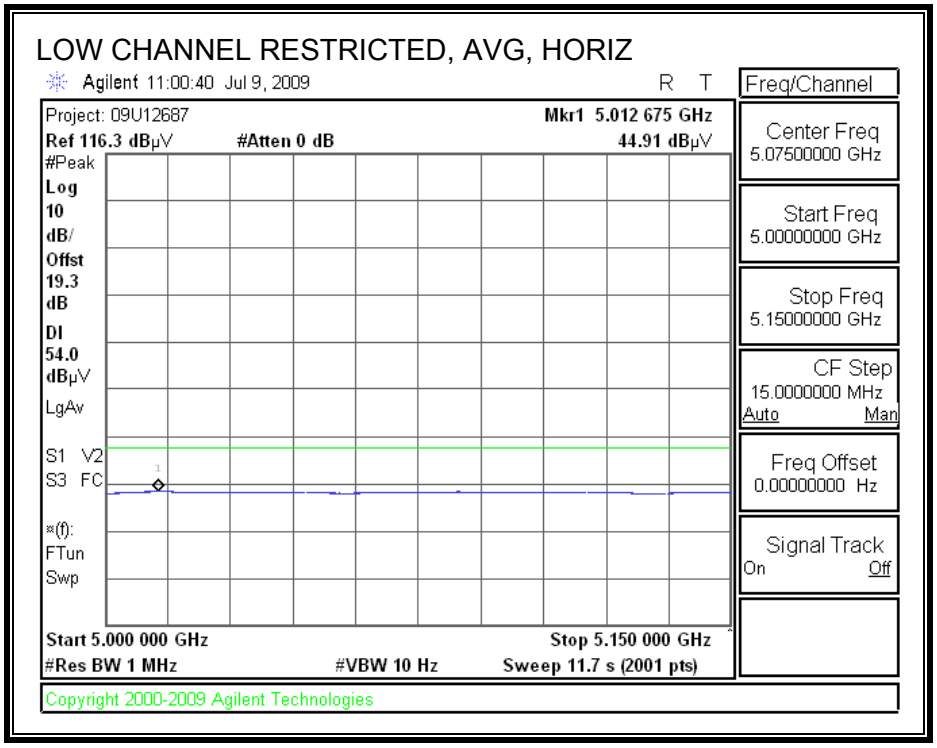
| f GHz | Dist (m) | Read dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Corr. dBuV/m | Limit dBuV/m | Margin dB | Ant. Pol. V/H | Det. P/A/QP | Ant.High cm | Table Angle Degree | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Low Ch 5180MHz** | | | | | | | | | | | | | | | |
| 15.540 | 3.0 | 36.0 | 38.9 | 11.3 | -34.8 | 0.0 | 10.0 | 61.4 | 74.0 | -12.6 | V | P | 145.0 | 233.3 | |
| 15.540 | 3.0 | 23.7 | 38.9 | 11.3 | -34.8 | 0.0 | 10.0 | 49.1 | 54.0 | -4.9 | V | A | 145.0 | 233.3 | |
| **Mid Ch 5200MHz** | | | | | | | | | | | | | | | |
| 15.600 | 3.0 | 37.2 | 38.7 | 11.4 | -34.8 | 0.0 | 10.0 | 62.5 | 74.0 | -11.5 | V | P | 199.8 | 319.8 | |
| 15.600 | 3.0 | 24.3 | 38.7 | 11.4 | -34.8 | 0.0 | 10.0 | 49.6 | 54.0 | -4.4 | V | A | 199.8 | 319.8 | |
| **High Ch 5240MHz** | | | | | | | | | | | | | | | |
| 15.720 | 3.0 | 36.9 | 38.4 | 11.4 | -34.7 | 0.0 | 10.0 | 62.0 | 74.0 | -12.0 | V | P | 200.0 | 75.6 | |
| 15.720 | 3.0 | 24.2 | 38.4 | 11.4 | -34.7 | 0.0 | 10.0 | 49.3 | 54.0 | -4.7 | V | A | 200.0 | 75.6 | |
| 10.480 | 3.0 | 36.1 | 37.5 | 9.0 | -36.7 | 0.0 | 10.0 | 55.8 | 74.0 | -18.2 | H | P | 121.7 | 358.7 | |
| 10.480 | 3.0 | 23.8 | 37.5 | 9.0 | -36.7 | 0.0 | 10.0 | 43.5 | 54.0 | -10.5 | H | A | 121.7 | 358.7 | |

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

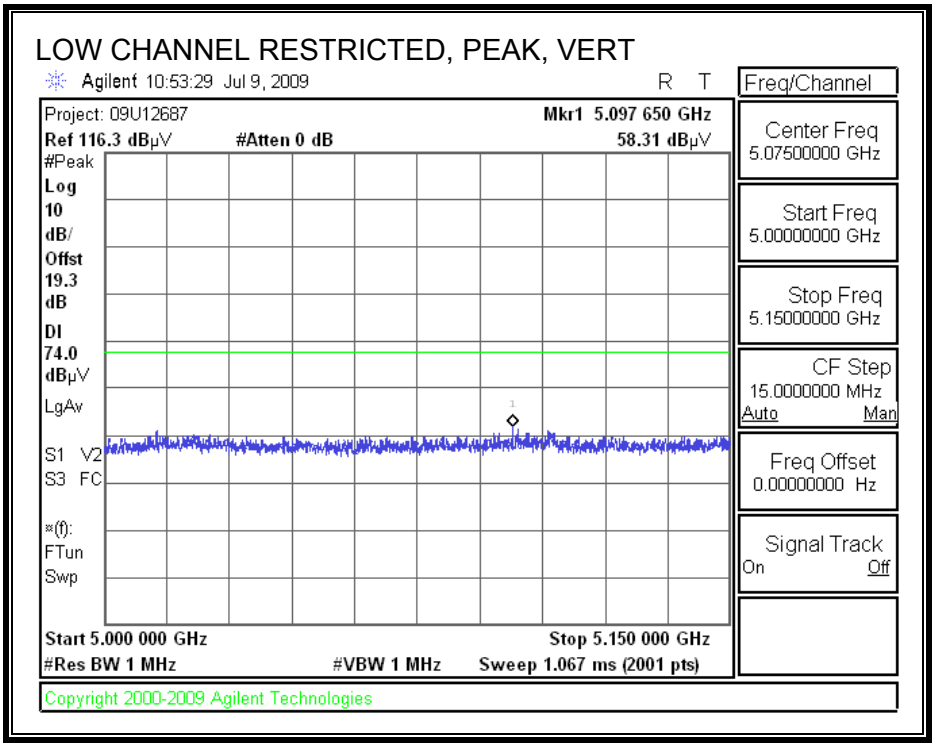
## 8.2.2. 802.11n HT20 MODE IN 5.2 GHz BAND

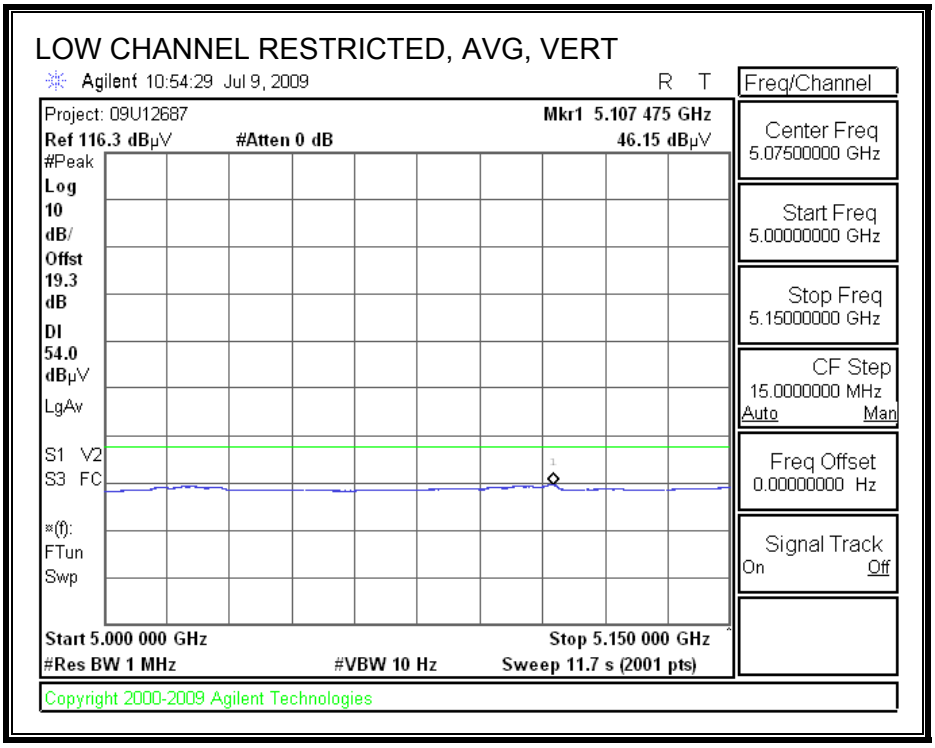
**RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)**



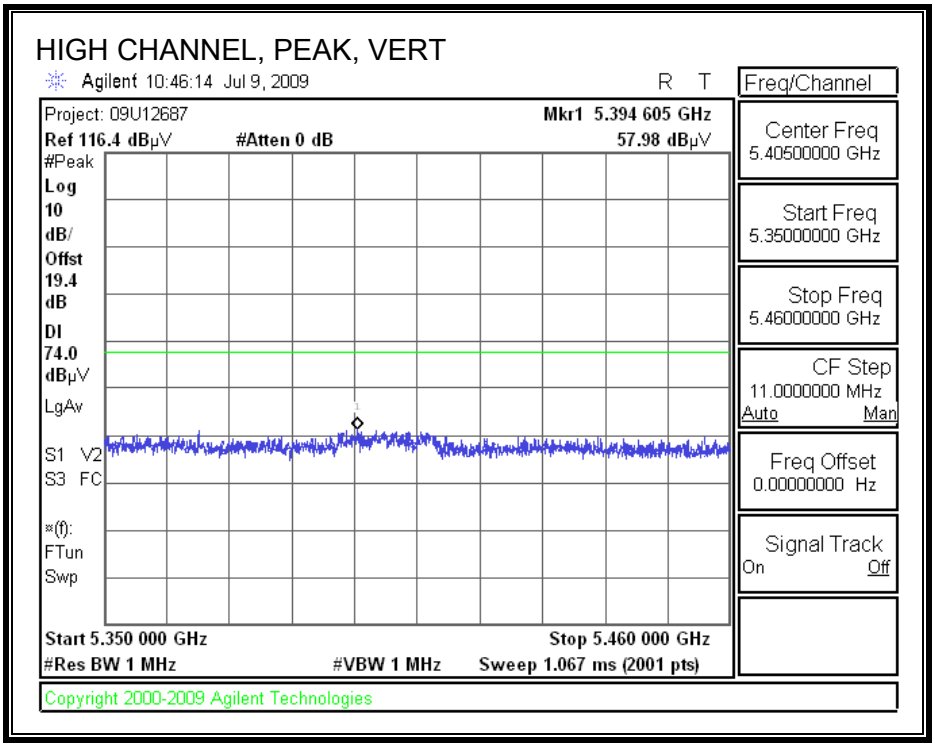



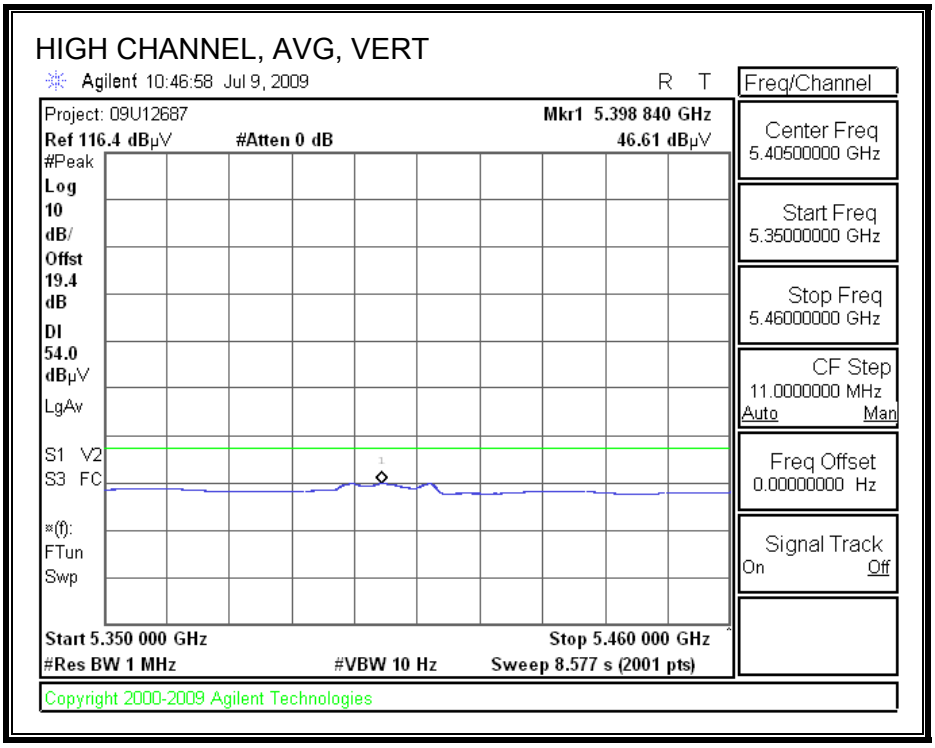
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



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



## HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Qualcomm
Project #: 09U12687
Date: 07/09/09
Test Engineer: Doug Anderson
Configuration: EUT w/Support Notebook PC
Mode: Tx / HT20

Test Equipment:

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T73; S/N: 6717 @3m | T144 Miteq 3008A00931 | | | FCC 15.205 |

Hi Frequency Cables

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

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

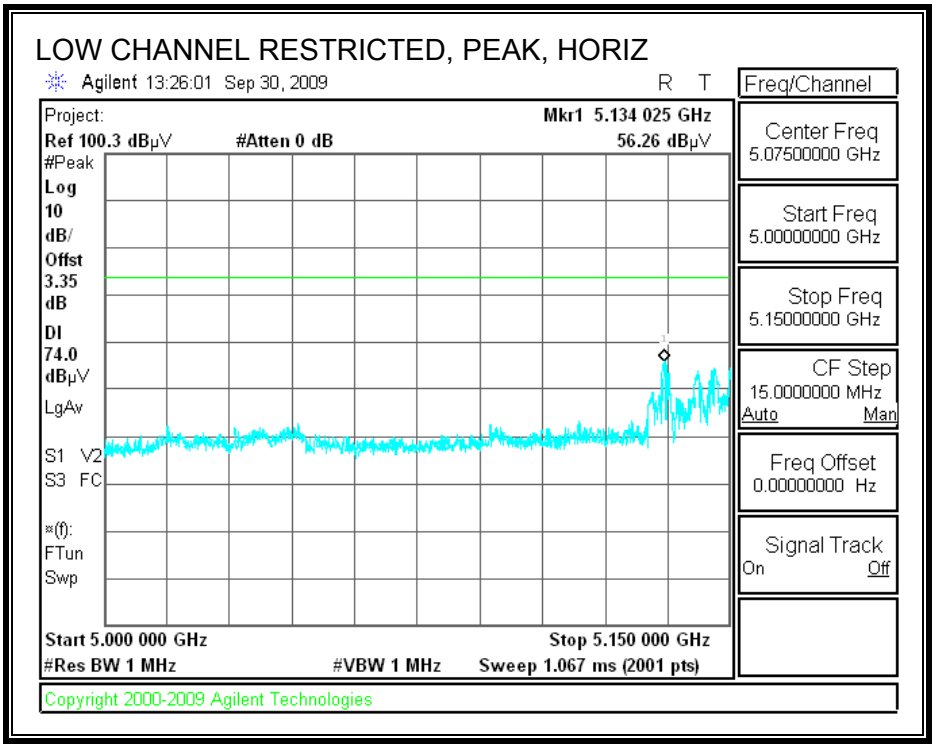
| f GHz | Dist (m) | Read Pk dBuV | Read Avg. dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Peak dBuV/m | Avg dBuV/m | Pk Lim dBuV/m | Avg Lim dBuV/m | Pk Mar dB | Avg Mar dB | Notes (V/H) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Low Ch. 5180** | | | | | | | | | | | | | | | |
| 15.540 | 3.0 | 44.5 | 29.6 | 38.7 | 11.3 | -34.8 | 0.0 | 0.7 | 60.4 | 45.5 | 74 | 54 | -13.6 | -8.5 | H (Noise Floor) |
| 15.540 | 3.0 | 44.5 | 29.6 | 38.7 | 11.3 | -34.8 | 0.0 | 0.7 | 60.4 | 45.5 | 74 | 54 | -13.6 | -8.5 | V (Noise Floor) |
| **Mid Ch. 5200** | | | | | | | | | | | | | | | |
| 15.600 | 3.0 | 43.6 | 29.8 | 38.5 | 11.4 | -34.8 | 0.0 | 0.7 | 59.4 | 45.7 | 74 | 54 | -14.6 | -8.3 | H (Noise Floor) |
| 15.600 | 3.0 | 43.4 | 29.9 | 38.5 | 11.4 | -34.8 | 0.0 | 0.7 | 59.2 | 45.7 | 74 | 54 | -14.8 | -8.3 | H (Noise Floor) |
| **High Ch. 5240** | | | | | | | | | | | | | | | |
| 15.720 | 3.0 | 43.7 | 29.6 | 38.2 | 11.4 | -34.7 | 0.0 | 0.7 | 59.3 | 45.3 | 74 | 54 | -14.7 | -8.7 | H (Noise Floor) |
| 15.720 | 3.0 | 43.6 | 29.7 | 38.2 | 11.4 | -34.7 | 0.0 | 0.7 | 59.3 | 45.3 | 74 | 54 | -14.7 | -8.7 | H (Noise Floor) |

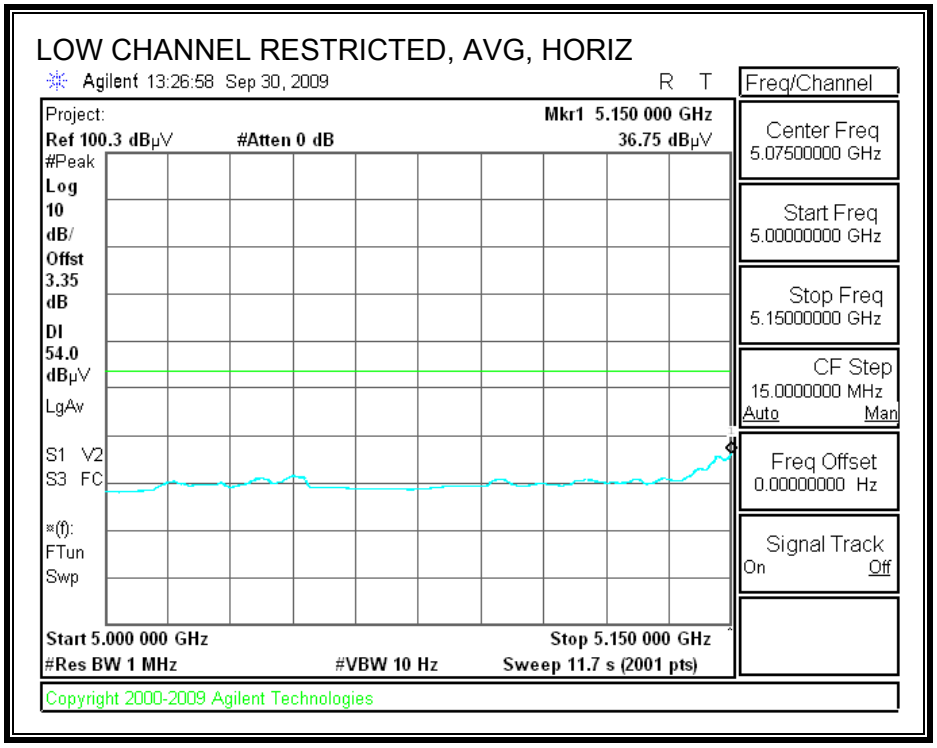
Rev. 11.10.08

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

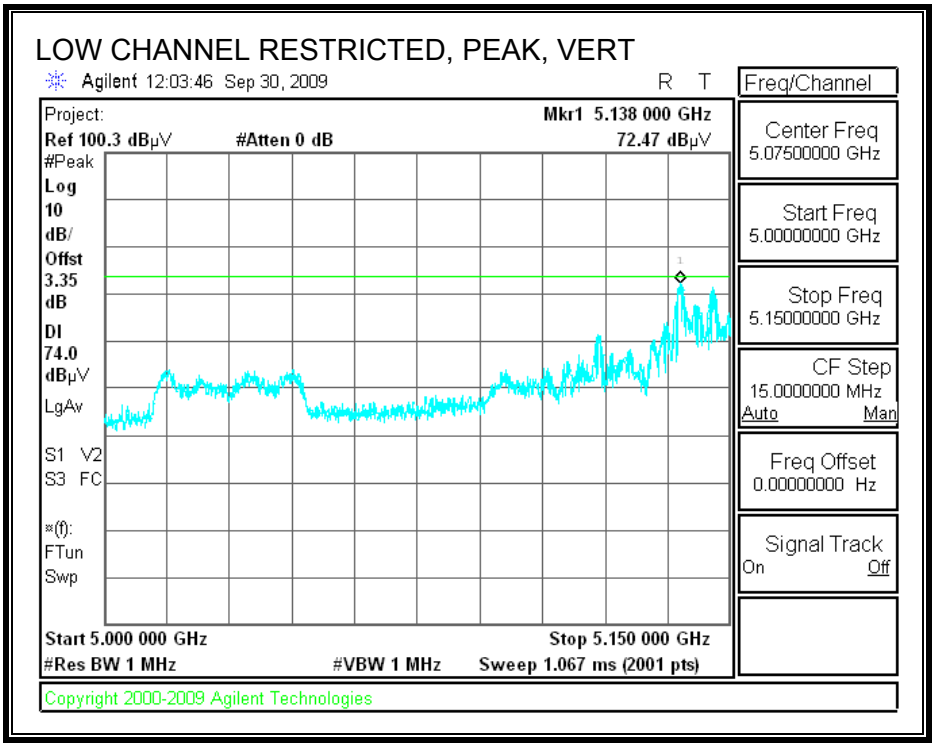
## 8.2.3. 802.11n HT40 MODE IN 5.2 GHz BAND

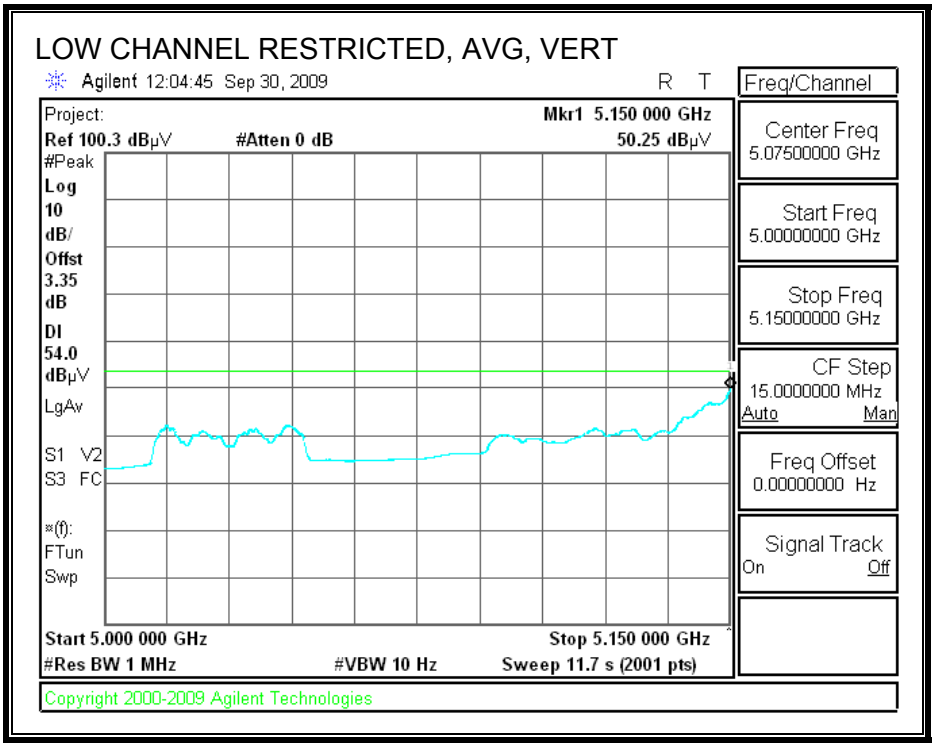
**RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)**



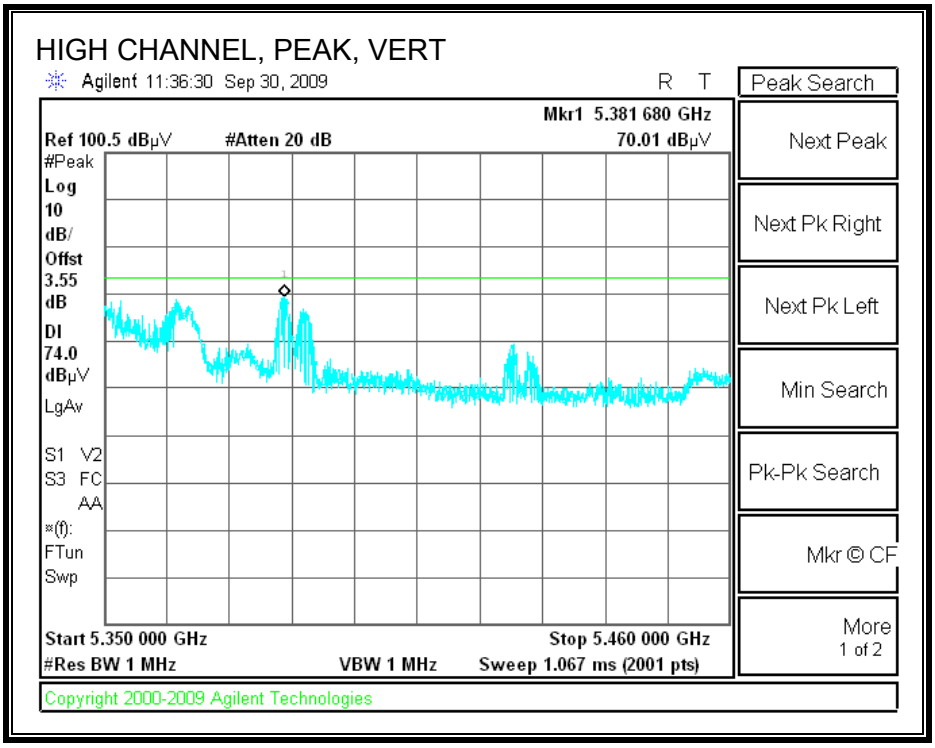



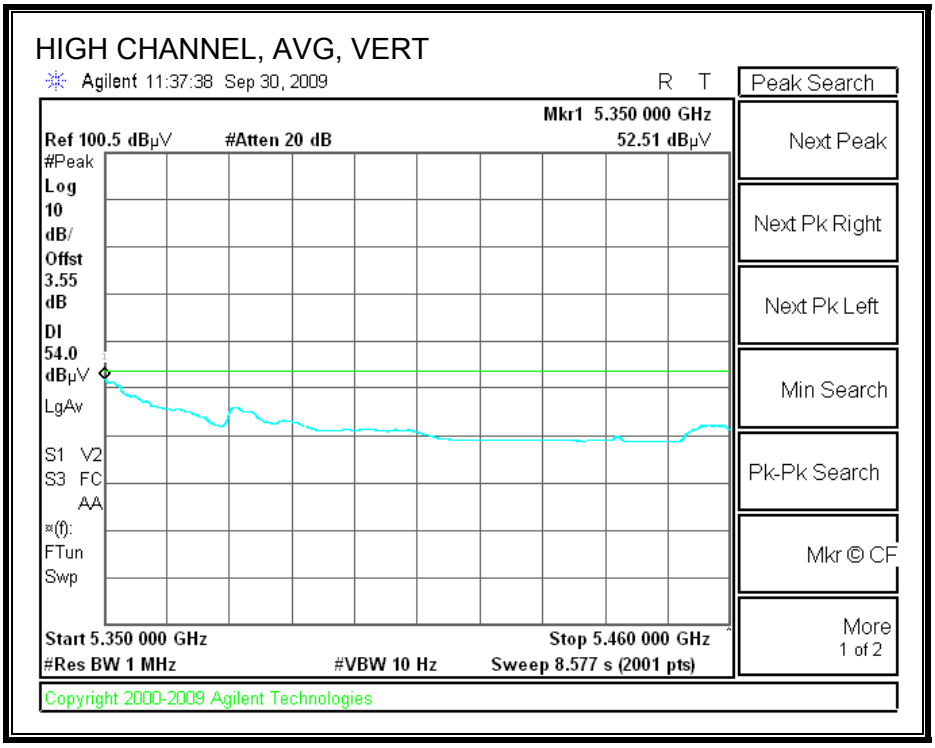
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



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



## HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Qualcomm
Project #: 09U12687
Date: 09/30/09
Test Engineer: Thanh Nguyen
Configuration: EUT w/Support Notebook PC
Mode: Tx HT 40, MCS 31

Test Equipment:

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T73; S/N: 6717 @3m | T144 Miteq 3008A00931 | | | FCC 15.205 |

Hi Frequency Cables

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

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

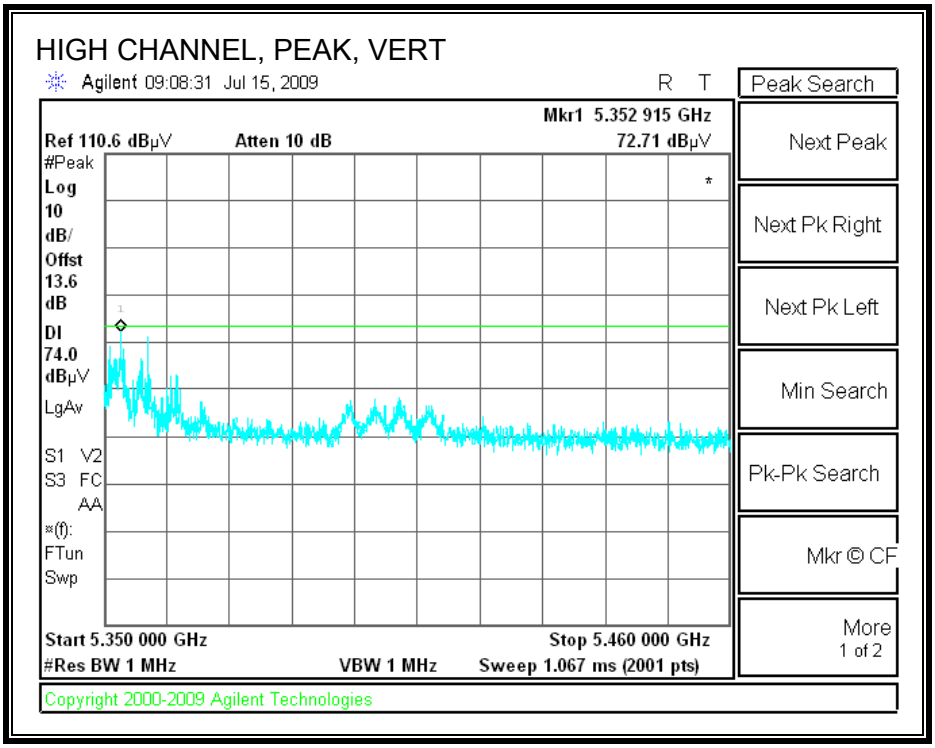
| f GHz | Dist (m) | Read Pk dBuV | Read Avg. dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Peak dBuV/m | Avg dBuV/m | Pk Lim dBuV/m | Avg Lim dBuV/m | Pk Mar dB | Avg Mar dB | Notes (V/H) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Low Ch. 5190 | | | | | | | | | | | | | | | |
| 15.570 | 3.0 | 36.4 | 23.4 | 38.6 | 11.4 | -34.8 | 0.0 | 0.7 | 52.3 | 39.3 | 74 | 54 | -21.7 | -14.7 | V (Noise Floor) |
| 15.570 | 3.0 | 34.8 | 23.4 | 38.6 | 11.4 | -34.8 | 0.0 | 0.7 | 50.6 | 39.3 | 74 | 54 | -23.4 | -14.7 | H (Noise Floor) |
| High Ch. 5230 | | | | | | | | | | | | | | | |
| 15.690 | 3.0 | 37.5 | 23.8 | 38.3 | 11.4 | -34.7 | 0.0 | 0.7 | 53.1 | 39.5 | 74 | 54 | -20.9 | -14.5 | H (Noise Floor) |
| 15.690 | 3.0 | 38.4 | 23.8 | 38.3 | 11.4 | -34.7 | 0.0 | 0.7 | 54.1 | 39.5 | 74 | 54 | -19.9 | -14.5 | V (Noise Floor) |

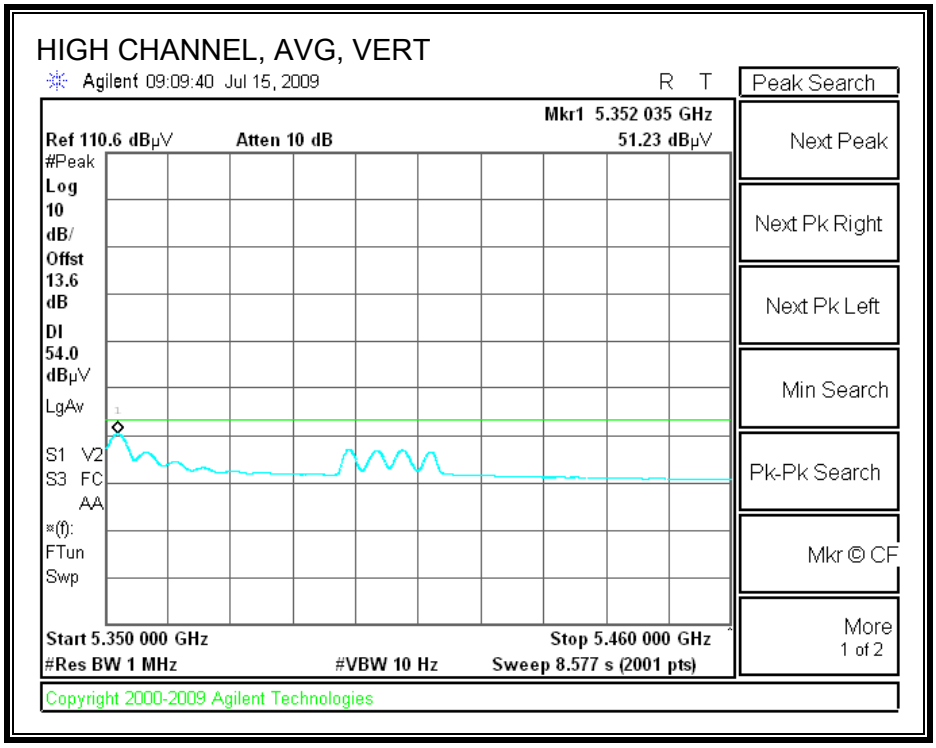
Rev. 11.10.08

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

## 8.2.4. 802.11a MODE IN 5.3 GHz BAND

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



## HARMONICS AND SPURIOUS EMISSIONS

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

**Test Engr:** Thanh Nguyen
**Date:** 07/15/09
**Project #:** 09U12687
**Company:** QualComm
**EUT Description:** PCI card
**EUT M/N:** 65-VN780-P2
**Test Target:** FCC15.247/15.407
**Mode Oper:** Tx a mode

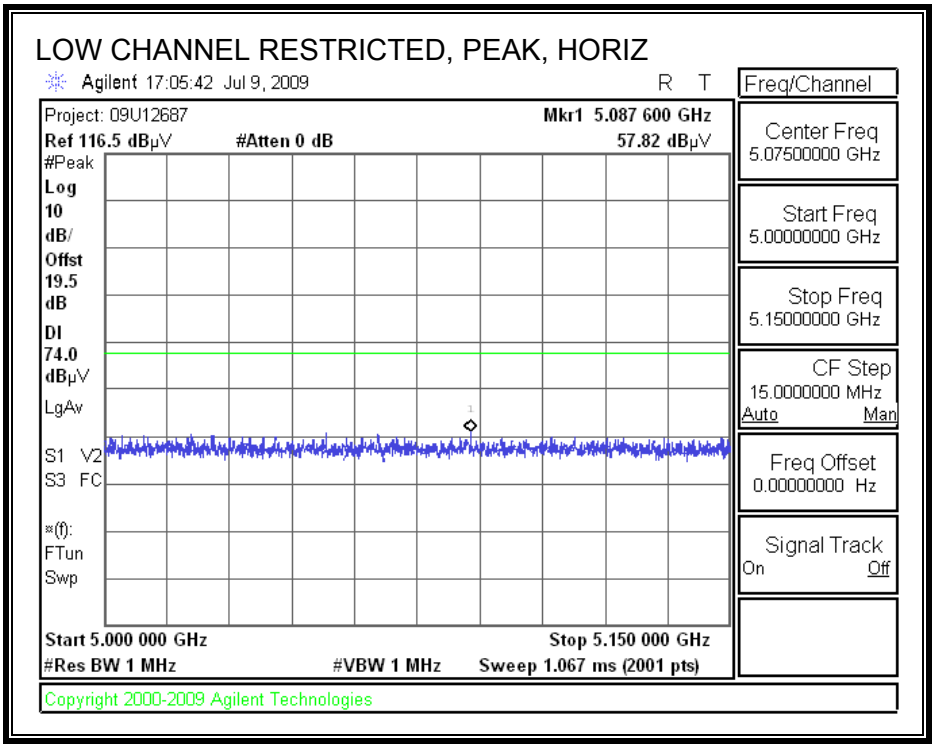
| | | | | |
|---|---|---|---|---|
| f | Measurement Frequency | Amp | Preamp Gain | Average Field Strength Limit |
| Dist | Distance to Antenna | D Corr | Distance Correct to 3 meters | Peak Field Strength Limit |
| Read | Analyzer Reading | Avg | Average Field Strength @ 3 m | Margin vs. Average Limit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

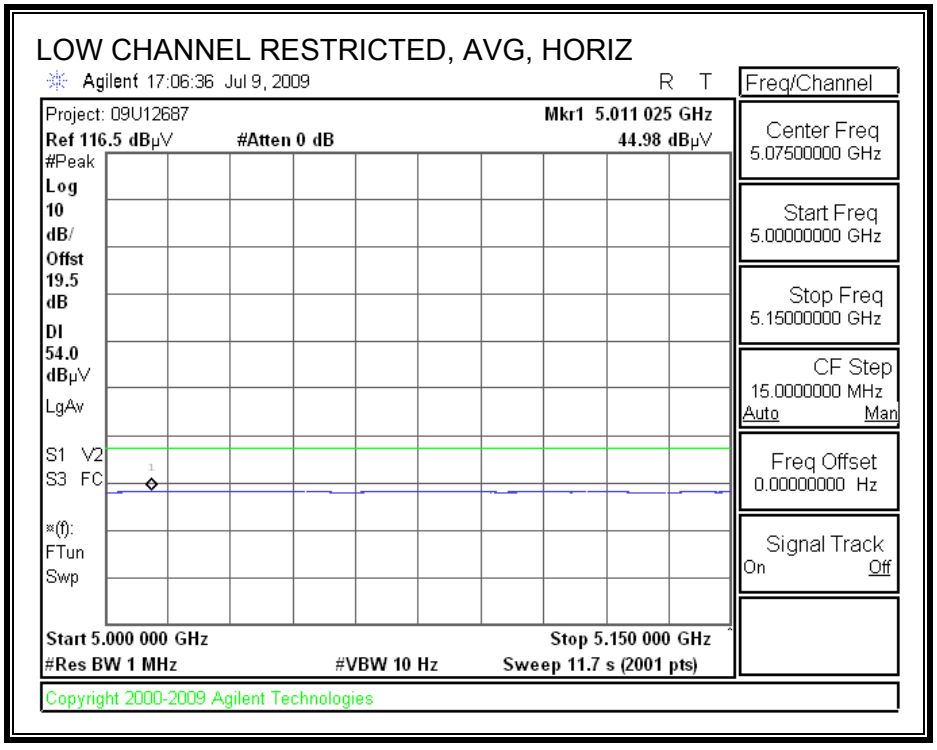
| f GHz | Dist (m) | Read dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Corr. dBuV/m | Limit dBuV/m | Margin dB | Ant. Pol. V/H | Det. P/A/QP | Ant.High cm | Table Angle Degree | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Low ch 5260MHz | | | | | | | | | | | | | | | |
| 15.780 | 3.0 | 40.1 | 38.0 | 11.5 | -34.6 | 0.0 | 0.7 | 55.6 | 74.0 | -18.4 | V | P | 135.5 | 322.5 | |
| 15.780 | 3.0 | 27.9 | 38.0 | 11.5 | -34.6 | 0.0 | 0.7 | 43.4 | 54.0 | -10.6 | V | A | 135.5 | 322.5 | |
| 15.780 | 3.0 | 37.0 | 38.0 | 11.5 | -34.6 | 0.0 | 0.7 | 52.6 | 74.0 | -21.4 | H | P | 129.2 | 298.4 | |
| 15.780 | 3.0 | 25.0 | 38.0 | 11.5 | -34.6 | 0.0 | 0.7 | 40.6 | 54.0 | -13.4 | H | A | 129.2 | 298.4 | |
| Mid ch 5300MHz | | | | | | | | | | | | | | | |
| 10.600 | 3.0 | 37.6 | 37.7 | 9.0 | -36.6 | 0.0 | 0.8 | 48.5 | 74.0 | -25.5 | V | P | 100.0 | 200.0 | |
| 10.600 | 3.0 | 26.5 | 37.7 | 9.0 | -36.6 | 0.0 | 0.8 | 37.4 | 54.0 | -16.6 | V | A | 100.0 | 200.0 | |
| 15.900 | 3.0 | 39.7 | 37.7 | 11.5 | -34.6 | 0.0 | 0.7 | 55.1 | 74.0 | -18.9 | V | P | 101.8 | 225.7 | |
| 15.900 | 3.0 | 27.3 | 37.7 | 11.5 | -34.6 | 0.0 | 0.7 | 42.6 | 54.0 | -11.4 | V | A | 101.8 | 225.7 | |
| 10.600 | 3.0 | 37.8 | 37.7 | 9.0 | -36.6 | 0.0 | 0.8 | 48.8 | 74.0 | -25.2 | H | P | 149.4 | 297.9 | |
| 10.600 | 3.0 | 25.5 | 37.7 | 9.0 | -36.6 | 0.0 | 0.8 | 36.5 | 54.0 | -17.5 | H | A | 149.4 | 297.9 | |
| 15.900 | 3.0 | 38.8 | 37.7 | 11.5 | -34.6 | 0.0 | 0.7 | 54.2 | 74.0 | -19.8 | H | P | 149.4 | 297.9 | |
| 15.900 | 3.0 | 26.0 | 37.7 | 11.5 | -34.6 | 0.0 | 0.7 | 41.3 | 54.0 | -12.7 | H | A | 149.4 | 297.9 | |
| High ch 5320MHz | | | | | | | | | | | | | | | |
| 10.640 | 3.0 | 46.5 | 37.7 | 9.1 | -36.6 | 0.0 | 0.8 | 57.4 | 74.0 | -16.6 | V | P | 134.2 | 291.0 | |
| 10.640 | 3.0 | 35.0 | 37.7 | 9.1 | -36.6 | 0.0 | 0.8 | 46.0 | 54.0 | -8.0 | V | A | 134.2 | 291.0 | |
| 15.960 | 3.0 | 44.5 | 37.5 | 11.5 | -34.5 | 0.0 | 0.7 | 59.8 | 74.0 | -14.2 | V | P | 131.1 | 318.8 | |
| 15.960 | 3.0 | 31.8 | 37.5 | 11.5 | -34.5 | 0.0 | 0.7 | 47.0 | 54.0 | -7.0 | V | A | 131.1 | 318.8 | |
| 10.640 | 3.0 | 37.8 | 37.7 | 9.1 | -36.6 | 0.0 | 0.8 | 48.8 | 74.0 | -25.2 | H | P | 147.1 | 295.3 | |
| 10.640 | 3.0 | 28.4 | 37.7 | 9.1 | -36.6 | 0.0 | 0.8 | 39.4 | 54.0 | -14.6 | H | A | 147.1 | 295.3 | |
| 15.960 | 3.0 | 40.3 | 37.5 | 11.5 | -34.5 | 0.0 | 0.7 | 55.6 | 74.0 | -18.4 | H | P | 145.9 | 266.9 | |
| 15.960 | 3.0 | 27.6 | 37.5 | 11.5 | -34.5 | 0.0 | 0.7 | 42.9 | 54.0 | -11.1 | H | A | 145.9 | 266.9 | |

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

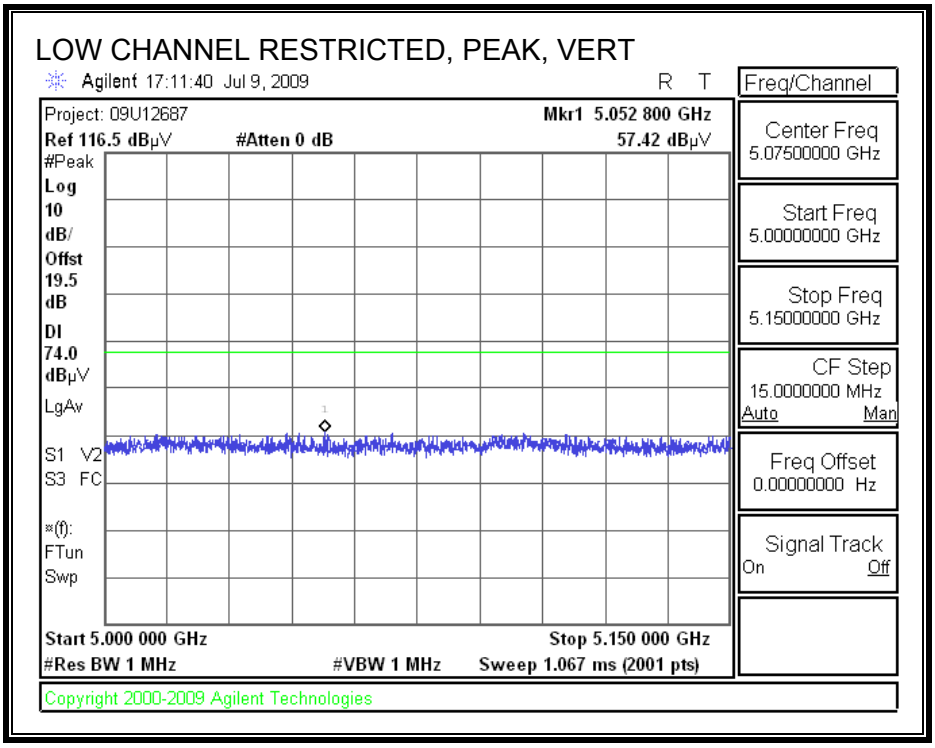
## 8.2.5. 802.11n HT20 MODE IN 5.3 GHz BAND

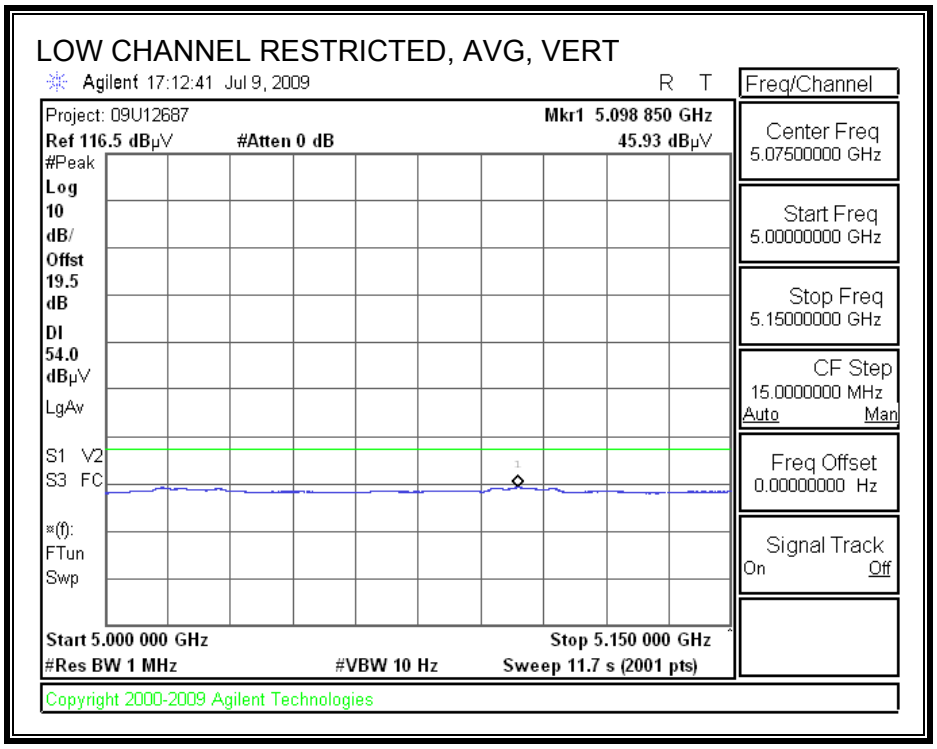
**RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)**



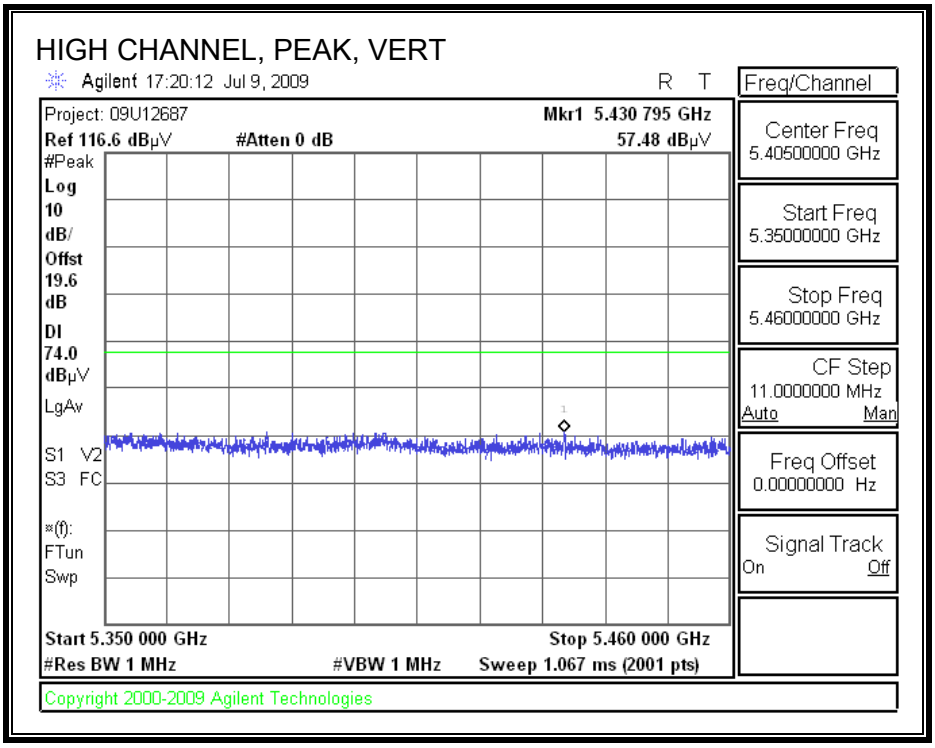



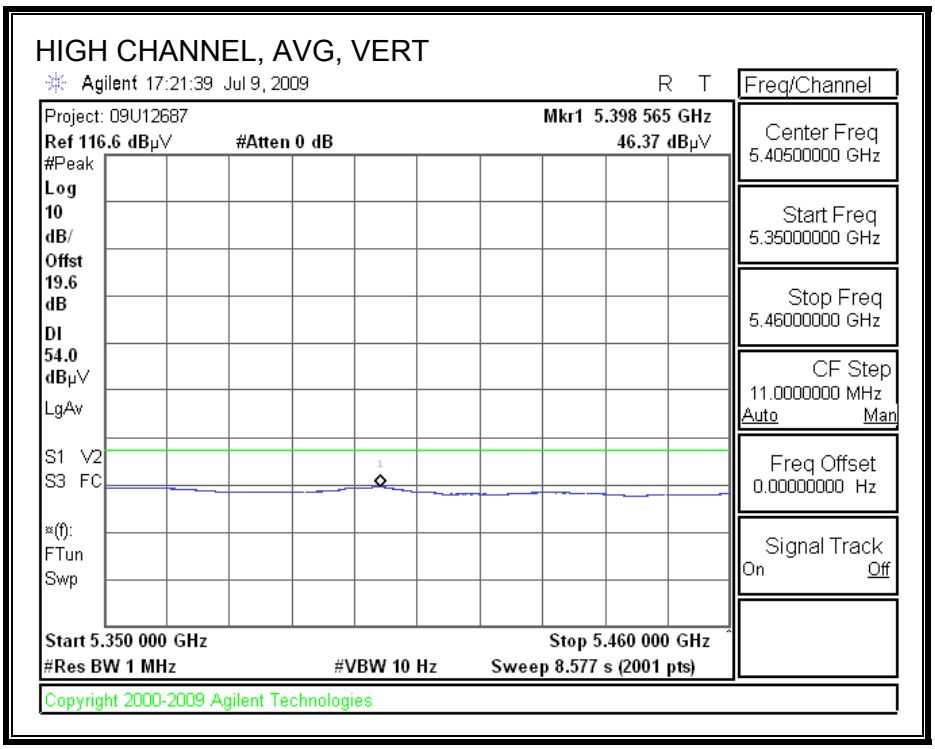
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



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



## HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Qualcomm
Project #: 09U12687
Date: 07/09/09
Test Engineer: Doug Anderson
Configuration: EUT w/Support Notebook PC
Mode: Tx / HT20

Test Equipment:

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T73; S/N: 6717 @3m | T144 Miteq 3008A00931 | | | FCC 15.205 |

Hi Frequency Cables

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

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

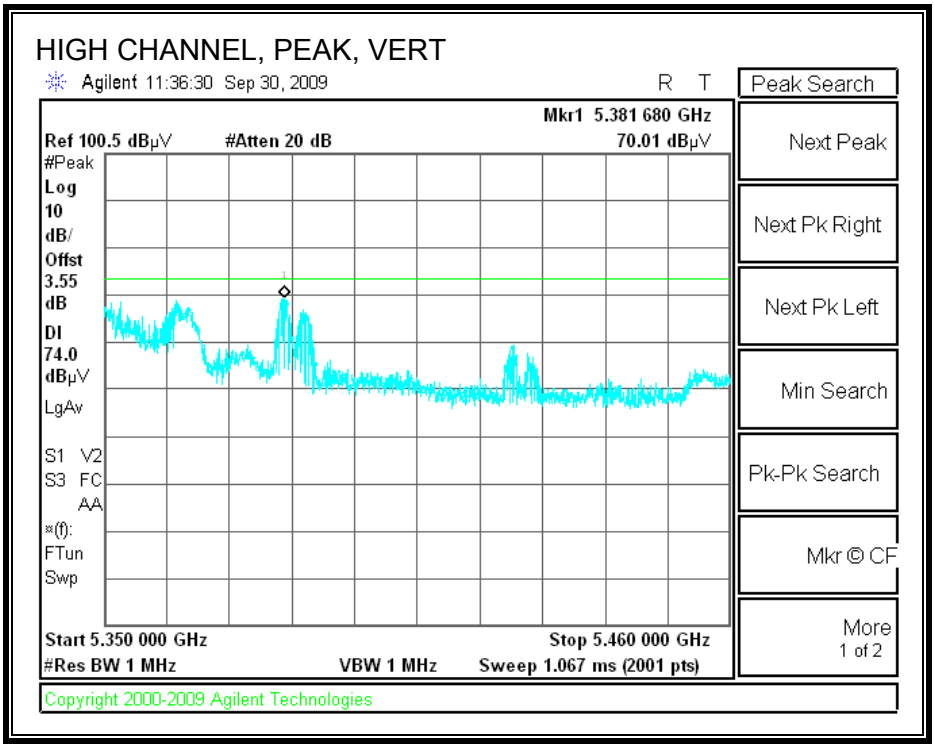
| f GHz | Dist (m) | Read Pk dBuV | Read Avg. dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Peak dBuV/m | Avg dBuV/m | Pk Lim dBuV/m | Avg Lim dBuV/m | Pk Mar dB | Avg Mar dB | Notes (V/H) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Low Ch. 5260 (Power = 11dBm) | | | | | | | | | | | | | | | |
| 15.780 | 3.0 | 42.5 | 29.3 | 38.0 | 11.5 | -34.6 | 0.0 | 0.7 | 58.1 | 44.9 | 74 | 54 | -15.9 | -9.1 | H (Noise Floor) |
| 15.780 | 3.0 | 42.4 | 29.4 | 38.0 | 11.5 | -34.6 | 0.0 | 0.7 | 57.9 | 45.0 | 74 | 54 | -16.1 | -9.0 | V (Noise Floor) |
| Mid Ch. 5300 (Power = 11dBm) | | | | | | | | | | | | | | | |
| 10.600 | 3.0 | 43.2 | 32.5 | 37.7 | 9.0 | -36.6 | 0.0 | 0.8 | 54.2 | 43.5 | 74 | 54 | -19.8 | -10.5 | H |
| 15.900 | 3.0 | 41.8 | 28.9 | 37.7 | 11.5 | -34.6 | 0.0 | 0.7 | 57.2 | 44.3 | 74 | 54 | -16.8 | -9.7 | H (Noise Floor) |
| 10.600 | 3.0 | 46.1 | 38.8 | 37.7 | 9.0 | -36.6 | 0.0 | 0.8 | 57.1 | 49.7 | 74 | 54 | -16.9 | -4.3 | V |
| 15.900 | 3.0 | 42.2 | 29.0 | 37.7 | 11.5 | -34.6 | 0.0 | 0.7 | 57.5 | 44.3 | 74 | 54 | -16.5 | -9.7 | V (Noise Floor) |
| High Ch. 5320 (Power = 11dBm) | | | | | | | | | | | | | | | |
| 10.640 | 3.0 | 43.2 | 32.9 | 37.7 | 9.1 | -36.6 | 0.0 | 0.8 | 54.2 | 43.8 | 74 | 54 | -19.8 | -10.2 | H |
| 15.960 | 3.0 | 41.7 | 28.9 | 37.5 | 11.5 | -34.5 | 0.0 | 0.7 | 57.0 | 44.2 | 74 | 54 | -17.0 | -9.8 | H (Noise Floor) |
| 10.640 | 3.0 | 45.7 | 38.2 | 37.7 | 9.1 | -36.6 | 0.0 | 0.8 | 56.7 | 49.2 | 74 | 54 | -17.3 | -4.8 | V |
| 15.960 | 3.0 | 41.5 | 28.9 | 37.5 | 11.5 | -34.5 | 0.0 | 0.7 | 56.8 | 44.2 | 74 | 54 | -17.2 | -9.8 | V (Noise Floor) |

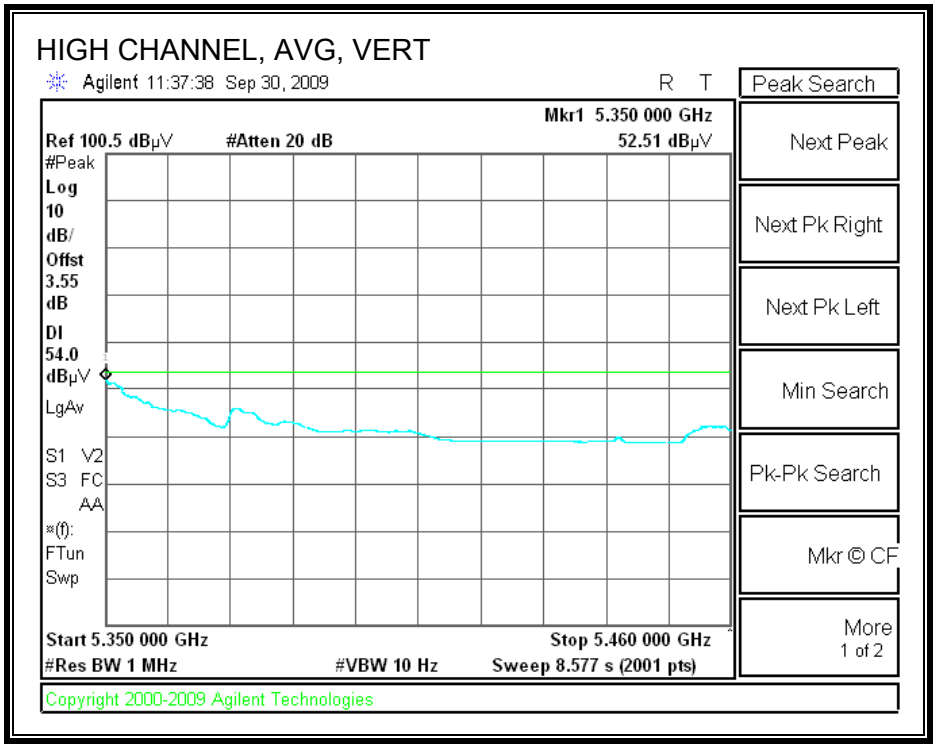
Rev. 11.10.08

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

## 8.2.6. 802.11n HT40 MODE IN 5.3 GHz BAND

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



## HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Qualcomm
Project #: 09U12687
Date: 09/30/09
Test Engineer: Thanh Ngyuen
Configuration: EUT w/Support Notebook PC
Mode: Tx / HT40, MCS 31

Test Equipment:

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T73; S/N: 6717 @3m | T144 Miteq 3008A00931 | | | FCC 15.205 |

Hi Frequency Cables

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

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

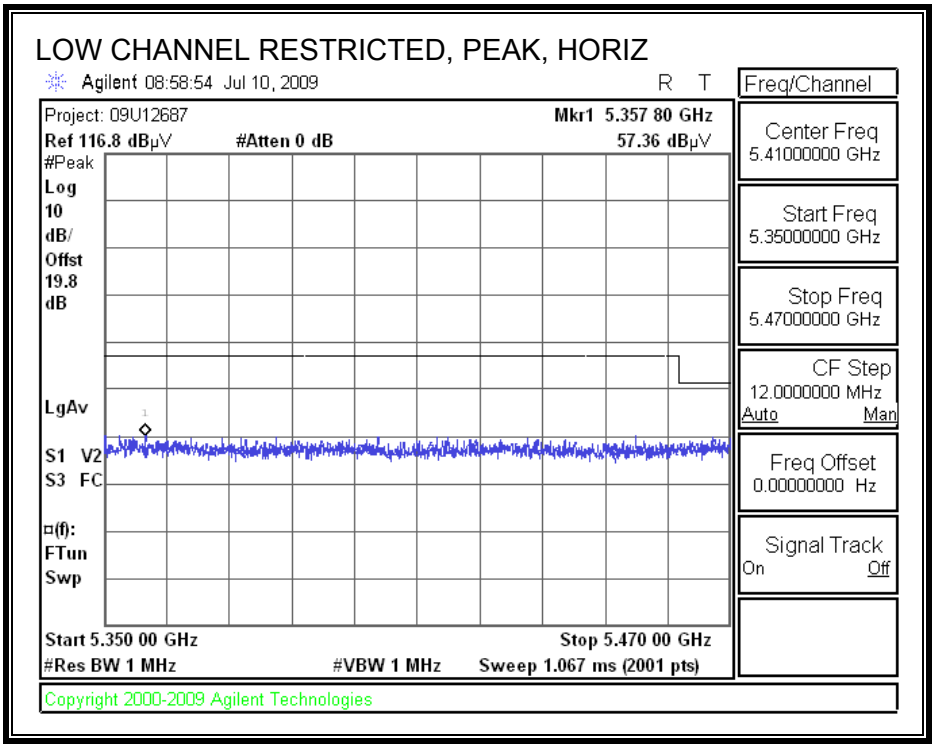
| f GHz | Dist (m) | Read Pk dBuV | Read Avg. dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Peak dBuV/m | Avg dBuV/m | Pk Lim dBuV/m | Avg Lim dBuV/m | Pk Mar dB | Avg Mar dB | Notes (V/H) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Low Ch. 5270 | | | | | | | | | | | | | | | |
| 15.810 | 3.0 | 44.2 | 33.8 | 37.9 | 11.5 | -34.6 | 0.0 | 0.7 | 59.7 | 49.3 | 74 | 54 | -14.3 | -4.7 | H |
| 15.810 | 3.0 | 46.3 | 37.2 | 37.9 | 11.5 | -34.6 | 0.0 | 0.7 | 61.8 | 52.7 | 74 | 54 | -12.2 | -1.3 | V |
| High Ch. 5310 | | | | | | | | | | | | | | | |
| 10.620 | 3.0 | 43.2 | 32.6 | 37.7 | 9.0 | -36.6 | 0.0 | 0.8 | 54.2 | 43.5 | 74 | 54 | -19.8 | -10.5 | H |
| 15.930 | 3.0 | 42.6 | 28.9 | 37.6 | 11.5 | -34.5 | 0.0 | 0.7 | 57.9 | 44.2 | 74 | 54 | -16.1 | -9.8 | H |
| 10.620 | 3.0 | 46.2 | 39.4 | 37.7 | 9.0 | -36.6 | 0.0 | 0.8 | 57.2 | 50.4 | 74 | 54 | -16.8 | -3.6 | V |
| 15.930 | 3.0 | 42.9 | 29.0 | 37.6 | 11.5 | -34.5 | 0.0 | 0.7 | 58.2 | 44.3 | 74 | 54 | -15.8 | -9.7 | V |

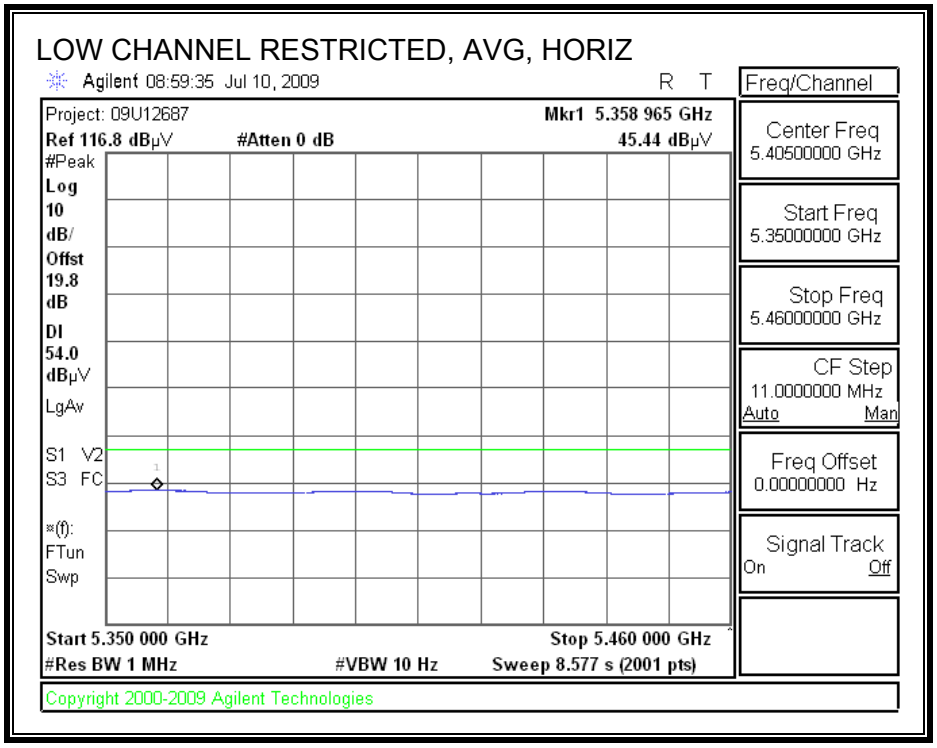
Rev. 11.10.08

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

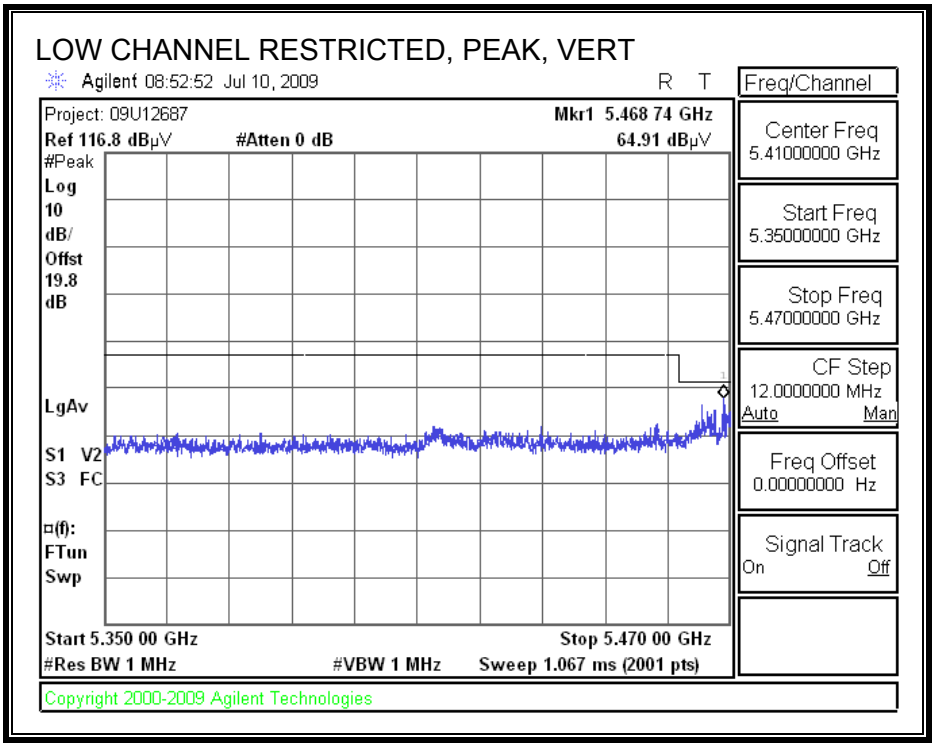
## 8.2.7. 802.11a MODE IN THE 5.6 GHz BAND

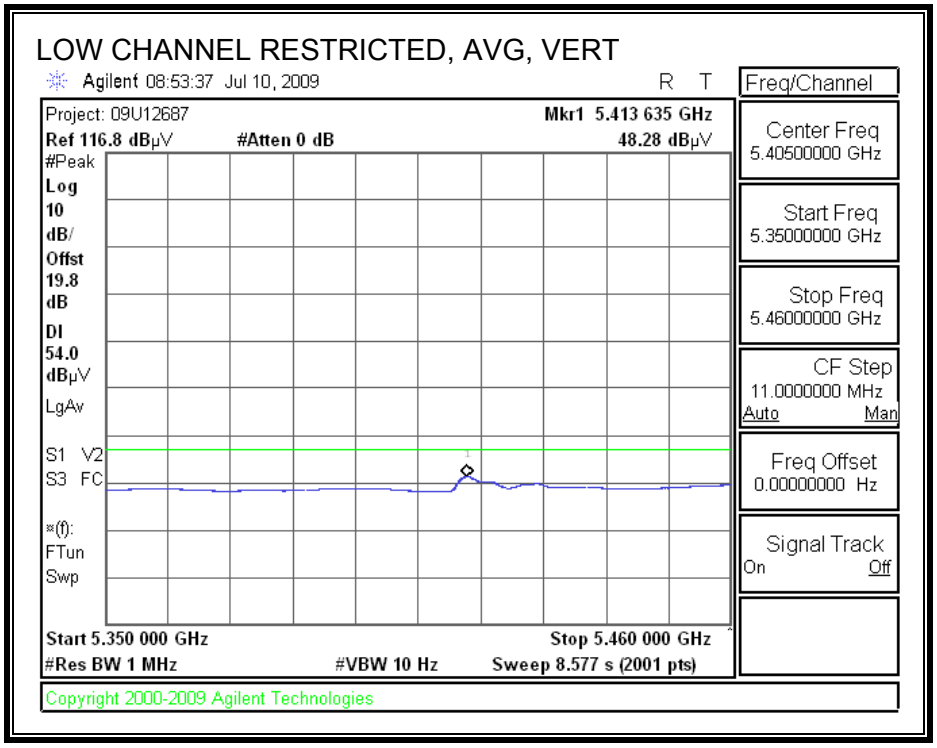
**RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)**



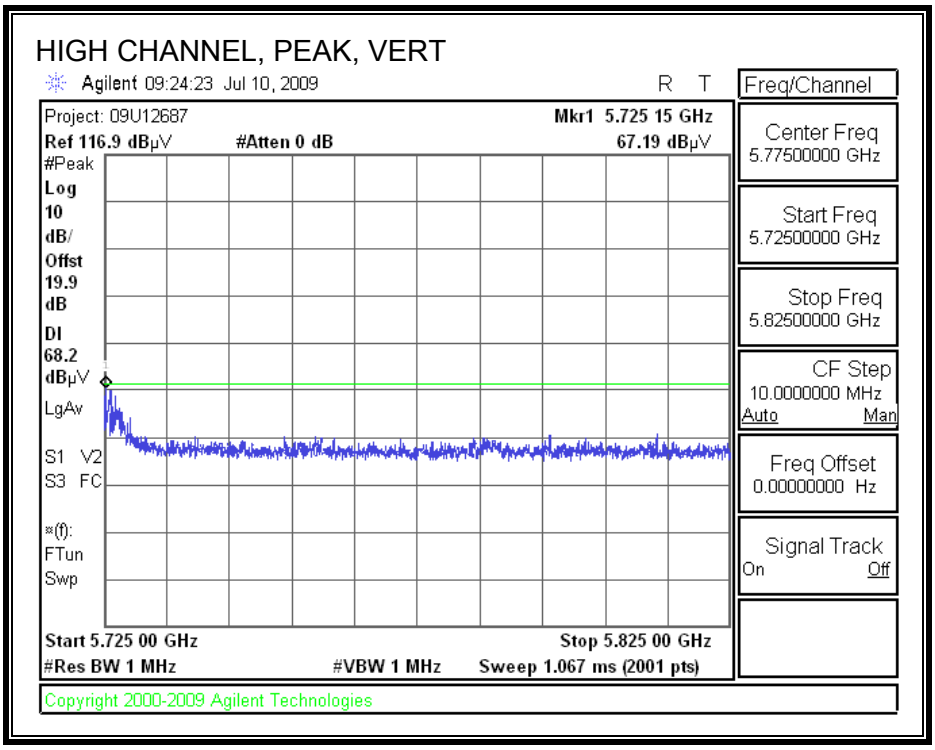



**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



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



## HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: QualComm
Project #: 09U12687
Date: 10/13/2009
Test Engineer: Thanh Nguyen
Configuration: EUT, Support Laptop
Mode: Tx / 802.11a

Test Equipment:

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T73; S/N: 6717 @3m | T144 Miteq 3008A00931 | | | FCC 15.205 |

Hi Frequency Cables

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

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

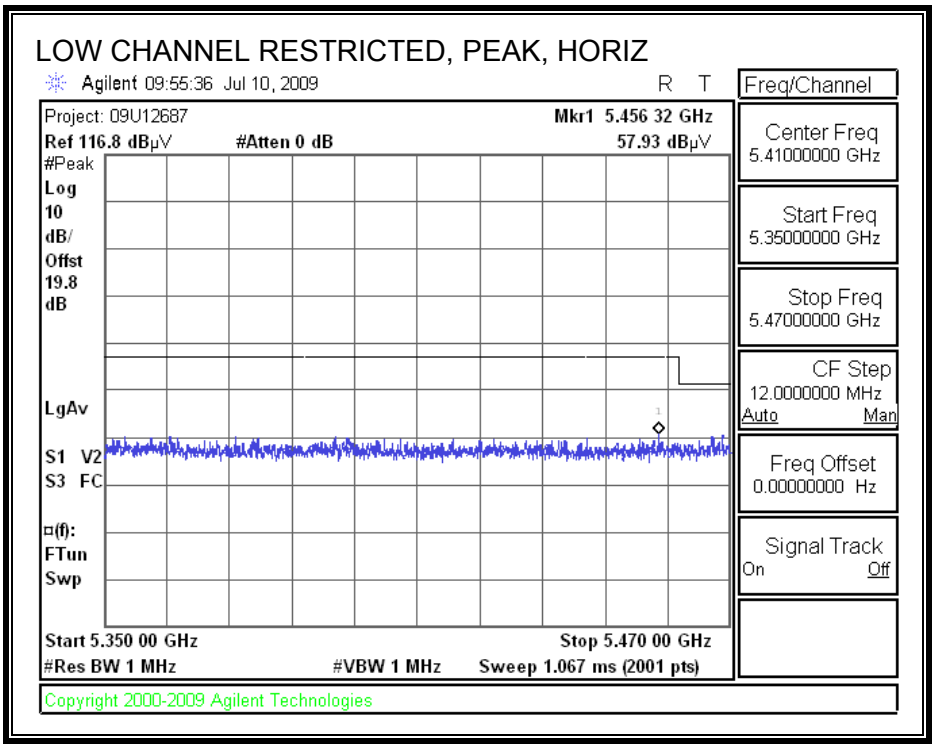
| f GHz | Dist (m) | Read Pk dBuV | Read Avg. dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Peak dBuV/m | Avg dBuV/m | Pk Lim dBuV/m | Avg Lim dBuV/m | Pk Mar dB | Avg Mar dB | Notes (V/H) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Low Ch. 5500 | | | | | | | | | | | | | | | |
| 11.000 | 3.0 | 40.6 | 27.1 | 37.9 | 9.2 | -36.3 | 0.0 | 0.7 | 52.2 | 38.7 | 74 | 54 | -21.8 | -15.3 | V |
| 11.000 | 3.0 | 39.6 | 27.5 | 37.9 | 9.2 | -36.3 | 0.0 | 0.7 | 51.2 | 39.1 | 74 | 54 | -22.8 | -14.9 | H |
| Ch. 5580 | | | | | | | | | | | | | | | |
| 11.160 | 3.0 | 38.7 | 25.5 | 38.0 | 9.3 | -36.1 | 0.0 | 0.7 | 50.7 | 37.4 | 74 | 54 | -23.3 | -16.6 | V |
| 11.160 | 3.0 | 36.4 | 23.4 | 38.0 | 9.3 | -36.1 | 0.0 | 0.7 | 48.4 | 35.4 | 74 | 54 | -25.6 | -18.6 | H |
| Ch. 5660 | | | | | | | | | | | | | | | |
| 11.320 | 3.0 | 42.3 | 34.5 | 38.2 | 9.4 | -36.0 | 0.0 | 0.7 | 54.6 | 46.8 | 74 | 54 | -19.4 | -7.2 | V |
| 11.320 | 3.0 | 41.2 | 34.4 | 38.2 | 9.4 | -36.0 | 0.0 | 0.7 | 53.5 | 46.8 | 74 | 54 | -20.5 | -7.2 | H |
| High Ch. 5700 | | | | | | | | | | | | | | | |
| 11.400 | 3.0 | 46.9 | 40.6 | 38.3 | 9.4 | -35.9 | 0.0 | 0.7 | 59.4 | 53.1 | 74 | 54 | -14.6 | -0.9 | V |
| 11.400 | 3.0 | 45.8 | 37.7 | 38.3 | 9.4 | -35.9 | 0.0 | 0.7 | 58.3 | 50.2 | 74 | 54 | -15.7 | -3.8 | H |

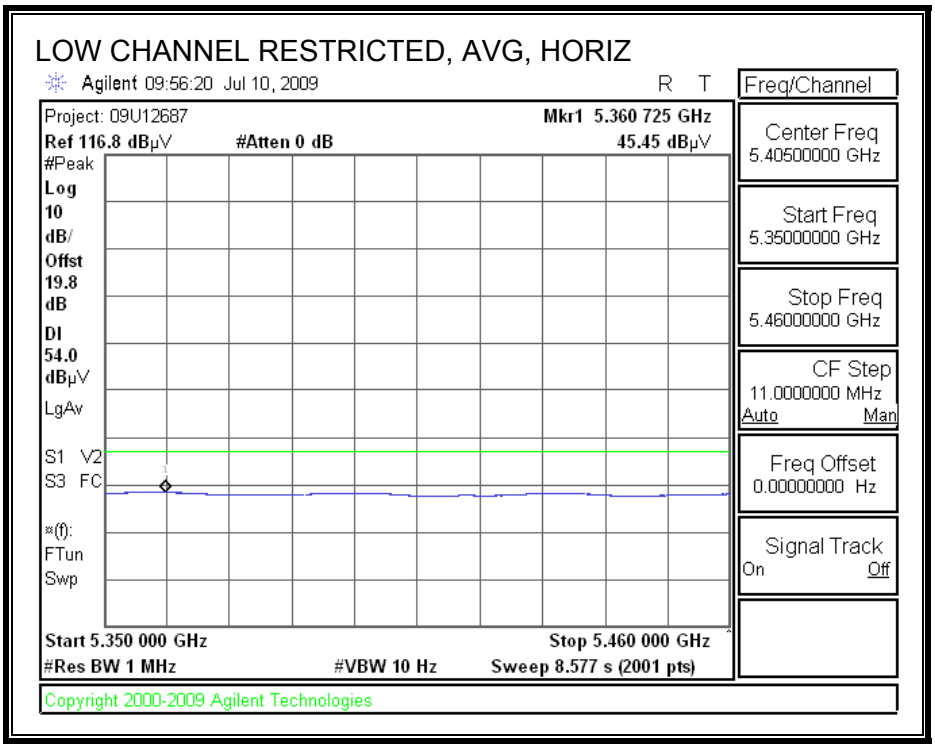
Rev. 11.10.08

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

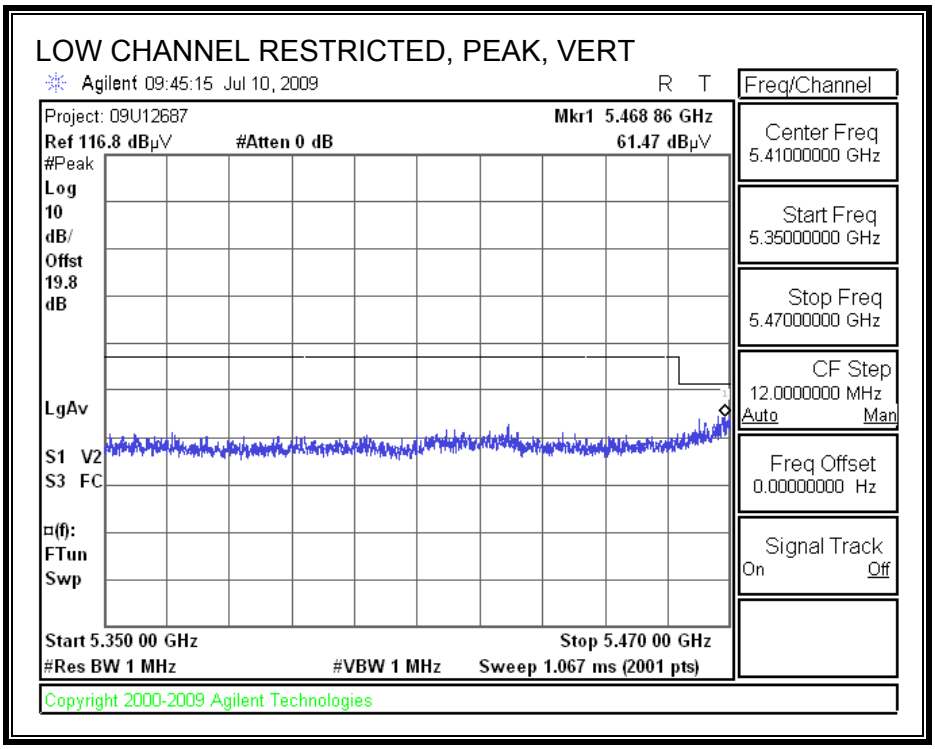
## 8.2.8. 802.11n HT20 MODE IN THE 5.6 GHz BAND

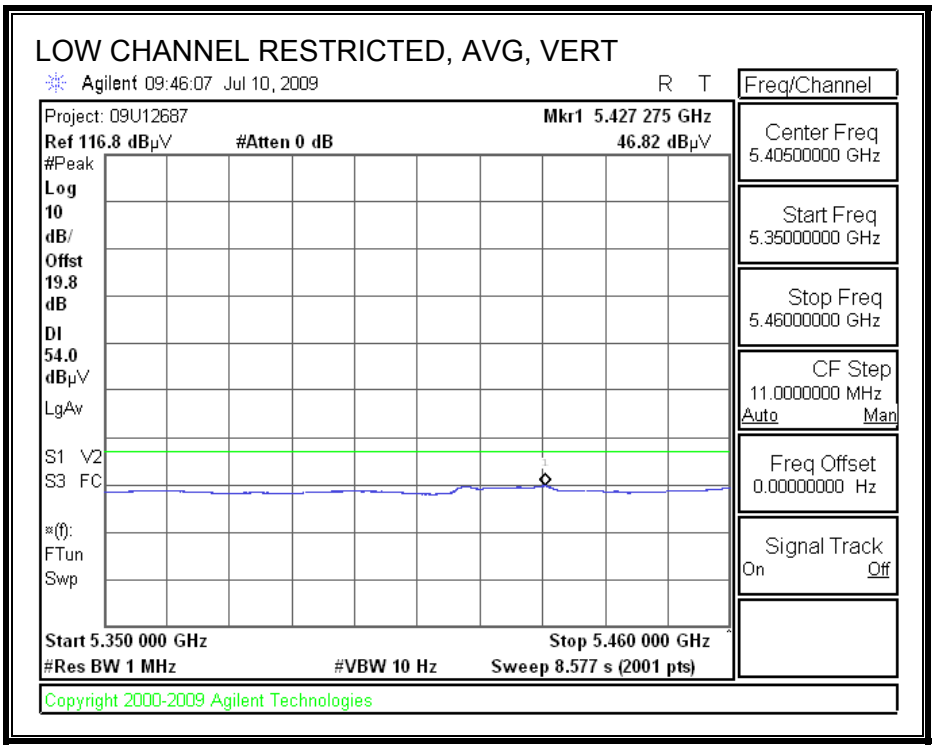
**RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)**



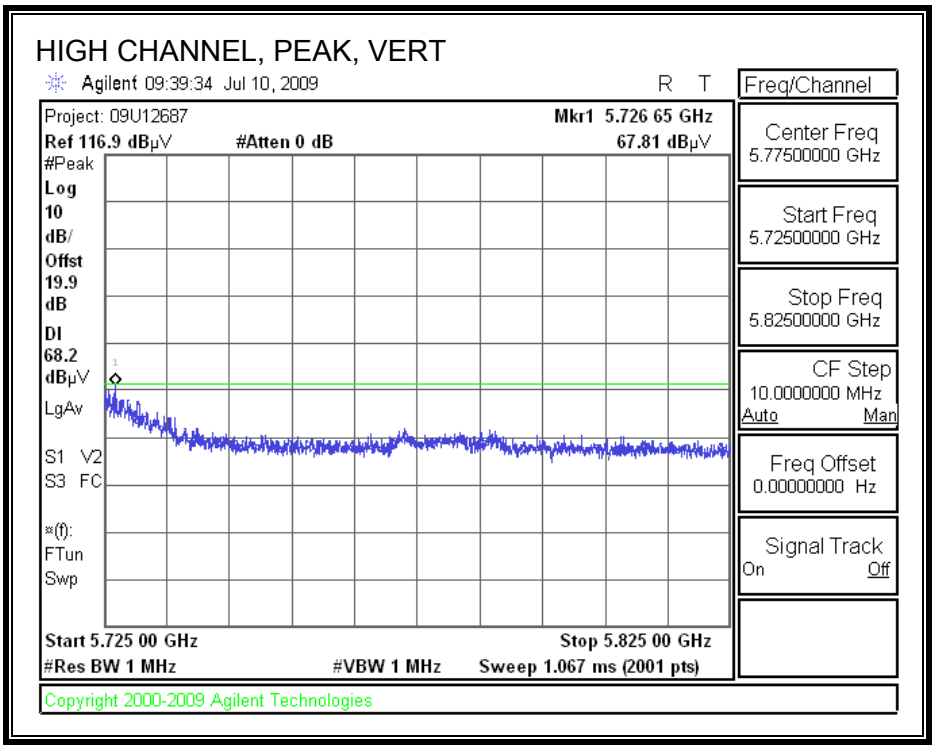



**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



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



## HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: QualComm
Project #: 09U12687
Date: 10/13/2009
Test Engineer: Thanh Nguyen
Configuration: EUT, Support Laptop
Mode: Tx / 802.11n HT20

Test Equipment:

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T73; S/N: 6717 @3m | T144 Miteq 3008A00931 | | | FCC 15.205 |

Hi Frequency Cables

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

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

| f GHz | Dist (m) | Read Pk dBuV | Read Avg. dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Peak dBuV/m | Avg dBuV/m | Pk Lim dBuV/m | Avg Lim dBuV/m | Pk Mar dB | Avg Mar dB | Notes (V/H) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Low Ch. 5500 | | | | | | | | | | | | | | | |
| 11.000 | 3.0 | 47.1 | 39.0 | 37.9 | 9.2 | -36.3 | 0.0 | 0.7 | 58.6 | 50.5 | 74 | 54 | -15.4 | -3.5 | V |
| 11.000 | 3.0 | 43.0 | 33.1 | 37.9 | 9.2 | -36.3 | 0.0 | 0.7 | 54.6 | 44.7 | 74 | 54 | -19.4 | -9.3 | H |
| Ch. 5580 | | | | | | | | | | | | | | | |
| 11.160 | 3.0 | 39.6 | 27.9 | 38.0 | 9.3 | -36.1 | 0.0 | 0.7 | 51.5 | 39.8 | 74 | 54 | -22.5 | -14.2 | V |
| 11.160 | 3.0 | 36.9 | 23.6 | 38.0 | 9.3 | -36.1 | 0.0 | 0.7 | 48.8 | 35.5 | 74 | 54 | -25.2 | -18.5 | H |
| Ch. 5660 | | | | | | | | | | | | | | | |
| 11.320 | 3.0 | 41.8 | 30.2 | 38.2 | 9.4 | -36.0 | 0.0 | 0.7 | 54.1 | 42.6 | 74 | 54 | -19.9 | -11.4 | V |
| 11.320 | 3.0 | 38.0 | 25.8 | 38.2 | 9.4 | -36.0 | 0.0 | 0.7 | 50.3 | 38.1 | 74 | 54 | -23.7 | -15.9 | H |
| High Ch. 5700 | | | | | | | | | | | | | | | |
| 11.400 | 3.0 | 47.5 | 40.9 | 38.3 | 9.4 | -35.9 | 0.0 | 0.7 | 60.0 | 53.4 | 74 | 54 | -14.0 | -0.6 | V |
| 11.400 | 3.0 | 44.8 | 34.7 | 38.3 | 9.4 | -35.9 | 0.0 | 0.7 | 57.3 | 47.3 | 74 | 54 | -16.7 | -6.7 | H |

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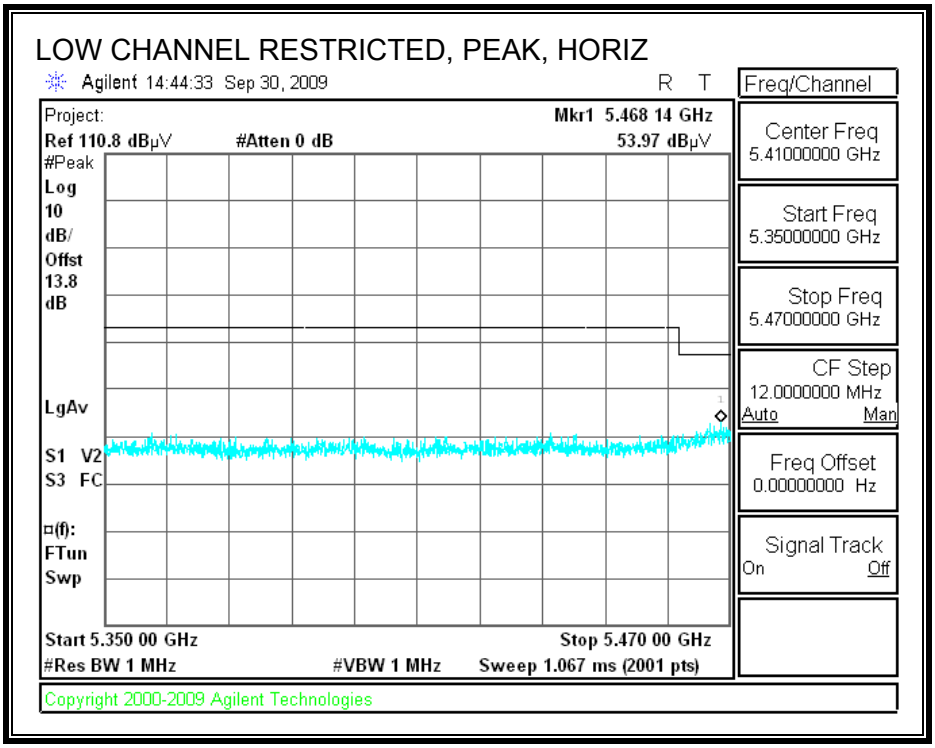
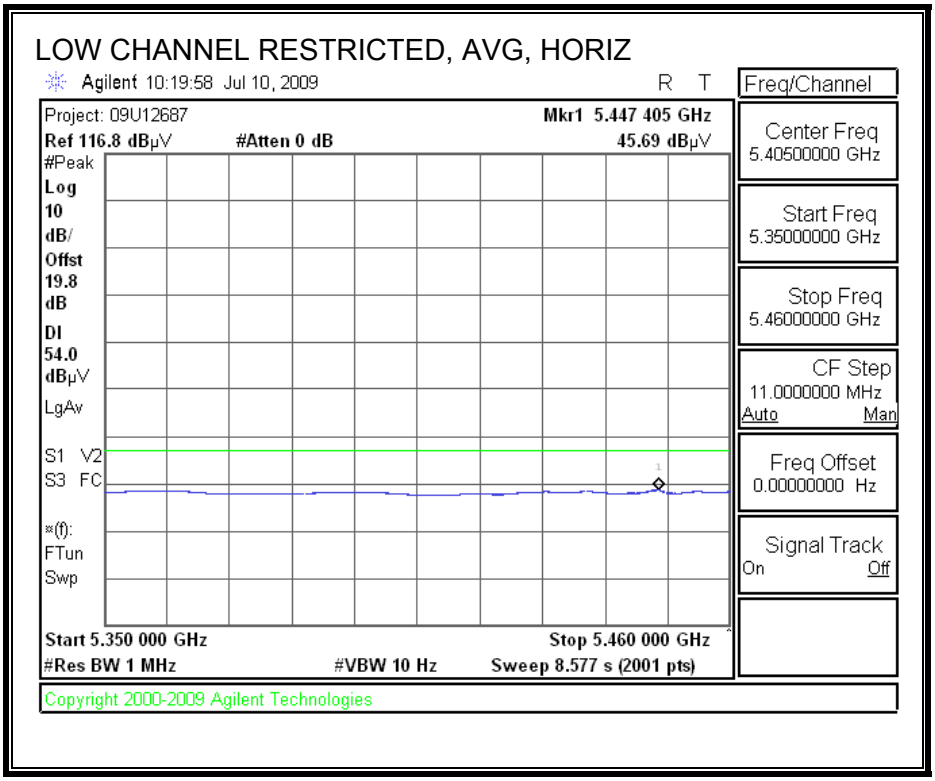
| | | | | | |
|---|---|---|---|---|---|
| f | Measurement Frequency | Amp | Preamp Gain | Avg Lim | Average Field Strength Limit |
| Dist | Distance to Antenna | D Corr | Distance Correct to 3 meters | Pk Lim | Peak Field Strength Limit |
| Read | Analyzer Reading | Avg | Average Field Strength @ 3 m | 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 | | |

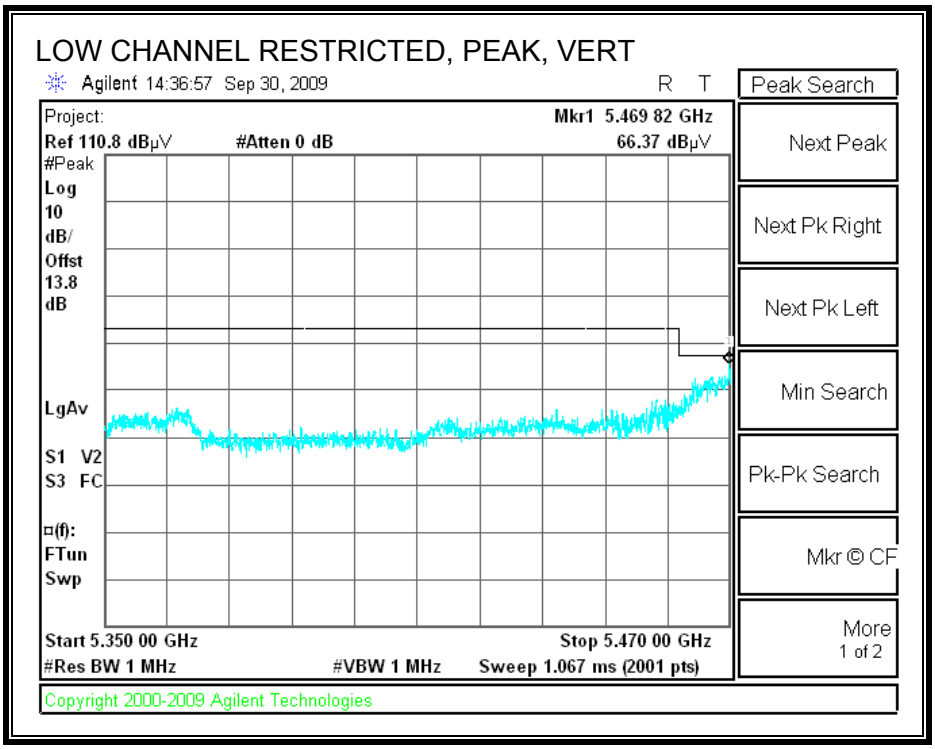
## 8.2.9. 802.11n HT40 MODE IN THE 5.6 GHz BAND

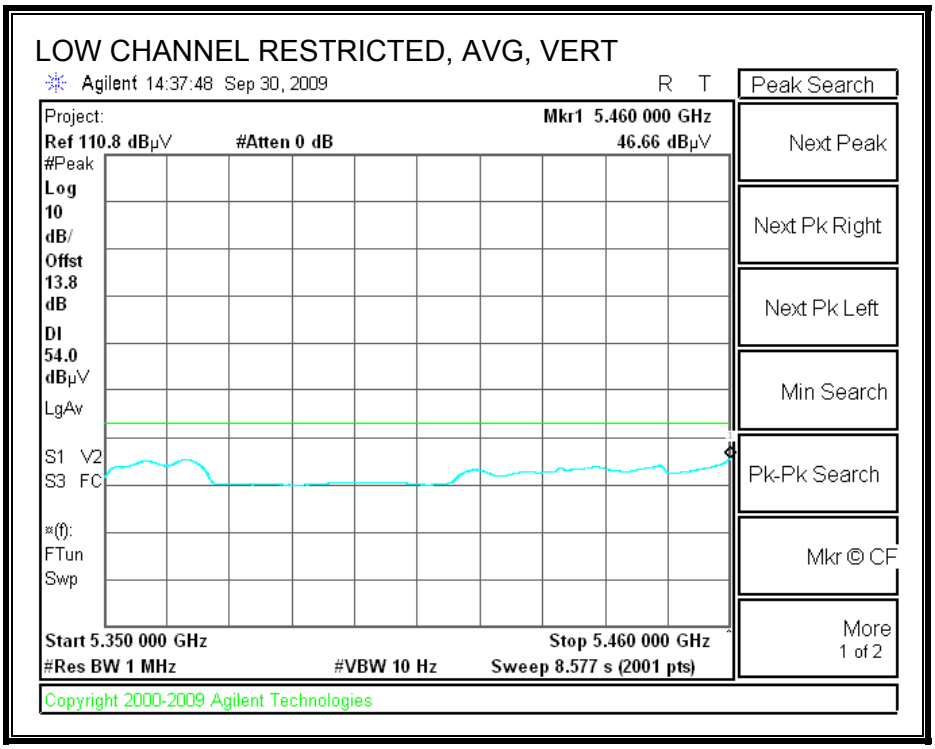
**RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)**



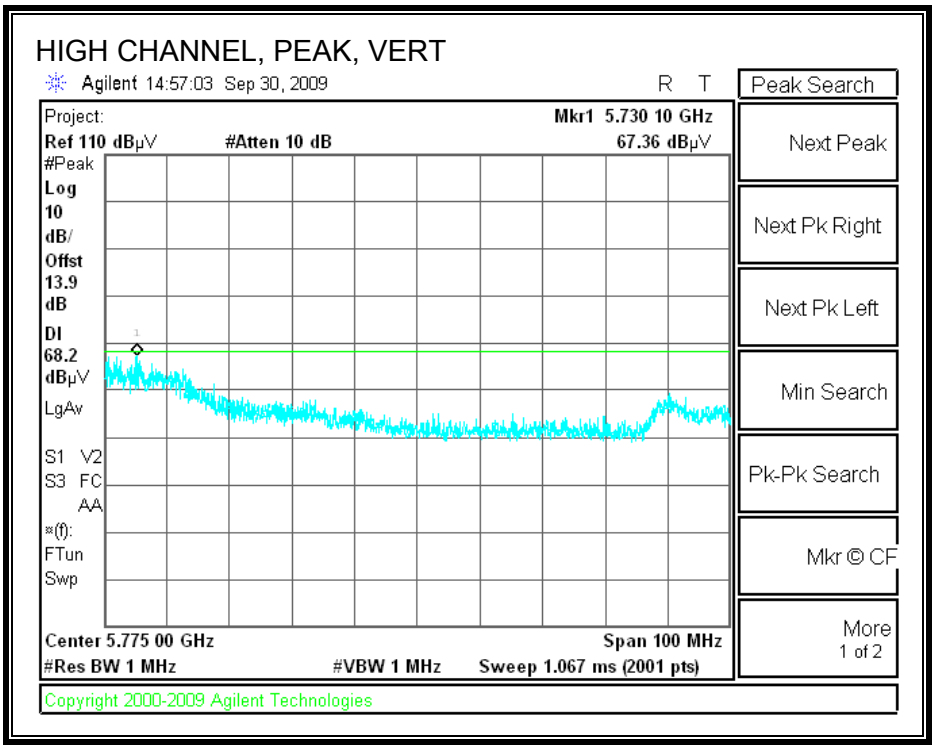



**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



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



## HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: QualComm
Project #: 09U12687
Date: 10/13/2009
Test Engineer: Thanh Nguyen
Configuration: EUT, Support Laptop
Mode: Tx / 802.11n HT40

Test Equipment:

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T73; S/N: 6717 @3m | T144 Miteq 3008A00931 | | | FCC 15.205 |

Hi Frequency Cables

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

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

| f GHz | Dist (m) | Read Pk dBuV | Read Avg. dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Peak dBuV/m | Avg dBuV/m | Pk Lim dBuV/m | Avg Lim dBuV/m | Pk Mar dB | Avg Mar dB | Notes (V/H) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ch. 5510MHz | | | | | | | | | | | | | | | |
| 11.020 | 3.0 | 43.8 | 38.0 | 37.9 | 9.2 | -36.3 | 0.0 | 0.7 | 55.4 | 49.7 | 74 | 54 | -18.6 | -4.3 | V |
| 11.020 | 3.0 | 41.7 | 34.1 | 37.9 | 9.2 | -36.3 | 0.0 | 0.7 | 53.3 | 45.7 | 74 | 54 | -20.7 | -8.3 | H |
| Ch. 5550 | | | | | | | | | | | | | | | |
| 11.100 | 3.0 | 39.2 | 27.2 | 38.0 | 9.3 | -36.2 | 0.0 | 0.7 | 51.0 | 39.0 | 74 | 54 | -23.0 | -15.0 | V |
| 11.100 | 3.0 | 37.4 | 24.3 | 38.0 | 9.3 | -36.2 | 0.0 | 0.7 | 49.2 | 36.1 | 74 | 54 | -24.8 | -17.9 | H |
| Ch. 5670MHz | | | | | | | | | | | | | | | |
| 11.340 | 3.0 | 45.7 | 39.4 | 38.2 | 9.4 | -36.0 | 0.0 | 0.7 | 58.1 | 51.8 | 74 | 54 | -15.9 | -2.2 | V |
| 11.340 | 3.0 | 42.3 | 34.4 | 38.2 | 9.4 | -36.0 | 0.0 | 0.7 | 54.7 | 46.8 | 74 | 54 | -19.3 | -7.2 | 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. WORST-CASE BELOW 1 GHz

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

HORIZONTAL

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

**Test Engr:** Thanh Nguyen
**Date:** 06/25/09
**Project #:** 09U12652
**Company:** QualCom Inc.
**EUT Description:** 802.11n 4x4 WLAN module
**EUT M/N:** 65-VN780-P1
**Test Target:** FCC Class B
**Mode Oper:** Tx worst case UNII band

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

| f MHz | Dist (m) | Read dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Filter dB | Corr. dBuV/m | Limit dBuV/m | Margin dB | Ant. Pol. V/H | Det. P/A/QP | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 90.002 | 3.0 | 52.1 | 7.6 | 0.8 | 28.3 | 0.0 | 0.0 | 32.2 | 43.5 | -11.3 | H | EP | |
| 234.608 | 3.0 | 51.0 | 11.9 | 1.3 | 28.2 | 0.0 | 0.0 | 36.0 | 46.0 | -10.0 | H | EP | |
| 299.171 | 3.0 | 51.5 | 13.4 | 1.5 | 28.1 | 0.0 | 0.0 | 38.2 | 46.0 | -7.8 | H | EP | |
| 429.136 | 3.0 | 45.8 | 15.4 | 1.9 | 28.0 | 0.0 | 0.0 | 35.1 | 46.0 | -10.9 | H | EP | |
| 639.985 | 3.0 | 44.1 | 18.9 | 2.3 | 27.4 | 0.0 | 0.0 | 37.9 | 46.0 | -8.1 | H | EP | |

**Rev. 1.27.09**
**Note: No other emissions were detected above the system noise floor.**

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

VERTICAL

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

**Test Engr:** Thanh Nguyen
**Date:** 06/25/09
**Project #:** 09U12652
**Company:** QualCom Inc.
**EUT Description:** 802.11n 4x4 WLAN module
**EUT M/N:** 65-VN780-P1
**Test Target:** FCC Class B
**Mode Oper:** Tx worst case UNII band

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

| f MHz | Dist (m) | Read dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Filter dB | Corr. dBuV/m | Limit dBuV/m | Margin dB | Ant. Pol. V/H | Det. P/A/QP | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 61.441 | 3.0 | 53.4 | 7.9 | 0.7 | 28.4 | 0.0 | 0.0 | 33.7 | 40.0 | -6.3 | V | EP | |
| 142.925 | 3.0 | 45.9 | 13.1 | 1.1 | 28.3 | 0.0 | 0.0 | 31.8 | 43.5 | -11.7 | V | EP | |
| 498.379 | 3.0 | 39.0 | 16.7 | 2.0 | 27.8 | 0.0 | 0.0 | 29.9 | 46.0 | -16.1 | V | EP | |
| 599.303 | 3.0 | 41.0 | 18.4 | 2.2 | 27.5 | 0.0 | 0.0 | 34.1 | 46.0 | -11.9 | V | EP | |
| 799.952 | 3.0 | 43.7 | 21.0 | 2.6 | 27.4 | 0.0 | 0.0 | 39.9 | 46.0 | -6.1 | V | EP | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

**Rev. 1.27.09**
**Note: No other emissions were detected above the system noise floor.**

# 9. AC POWER LINE CONDUCTED EMISSIONS

**LIMITS**

FCC §15.207 (a)

RSS-Gen 7.2.2

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

* Decreases with the logarithm of the frequency.

**TEST PROCEDURE**

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

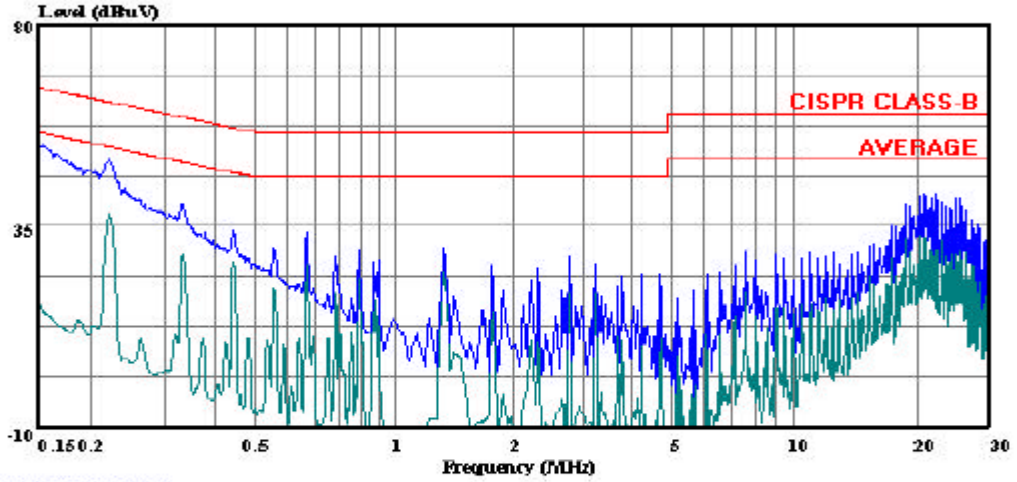
## 6 WORST EMISSIONS

| CONDUCTED EMISSIONS DATA (115VAC 60Hz) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Freq. | Reading | | | Closs | Limit | EN_B | Margin | | Remark |
| (MHz) | PK (dBuV) | QP (dBuV) | AV (dBuV) | (dB) | QP | AV | QP (dB) | AV (dB) | L1 / L2 |
| 0.22 | 49.94 | -- | 36.55 | 0.00 | 62.74 | 52.74 | -12.80 | -16.19 | L1 |
| 0.33 | 39.76 | -- | 28.62 | 0.00 | 59.35 | 49.35 | -19.59 | -20.73 | L1 |
| 21.15 | 41.63 | -- | 37.25 | 0.00 | 60.00 | 50.00 | -18.37 | -12.75 | L1 |
| 0.22 | 49.89 | -- | 36.03 | 0.00 | 62.82 | 52.82 | -12.93 | -16.79 | L2 |
| 0.33 | 39.80 | -- | 27.12 | 0.00 | 59.35 | 49.35 | -19.55 | -22.23 | L2 |
| 21.71 | 38.81 | -- | 32.20 | 0.00 | 60.00 | 50.00 | -21.19 | -17.80 | 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#: 32 File#: 09U12652 LC.EMI Date: 06-26-2009 Time: 14:57:07




(Line Conduction)

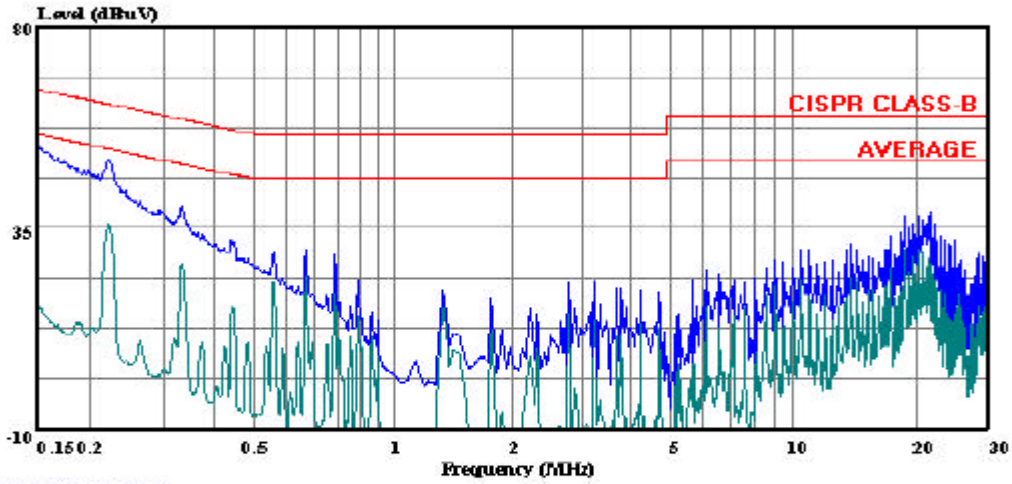
Trace: 30 Ref Trace:

Condition: CISPR CLASS-B
Test Operator: : Thanh Nguyen
Project #: : 09U12652
Company: : Qualcomm
EUT Description:: 802.11n 4x4 WLAN Module
: 5000 Series PCIe, 2.4 and 5GHz AP router
Mode: : Tx 5 GHz Band
Target: : FCC Class B
Voltage: : 115VAC, 60Hz
: L1: Peak ( Blue ) , Average (Green )

**LINE 2 RESULTS**

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

Data#: 25 File#: 09U12652 LC.EMI Date: 06-26-2009 Time: 14:46:54




(Line Conduction)

Trace: 23 Ref Trace:

Condition: CISPR CLASS-B
Test Operator: : Thanh Nguyen
Project #: : 09U12652
Company: : Qualcomm
EUT Description:: 802.11n 4x4 WLAN Module
: 5000 Series PCIe, 2.4 and 5GHz AP router
Mode: : Tx 5 GHz Band
Target: : FCC Class B
Voltage: : 115VAC, 60Hz
: L2: Peak ( Blue ) , Average (Green )

# 10. DYNAMIC FREQUENCY SELECTION

## 10.1. OVERVIEW

### 10.1.1. LIMITS

**INDUSTRY CANADA**

IC RSS-210 is closely harmonized with FCC Part 15 DFS rules. The deviations are as follows:

RSS-210 Issue 7 A9.4 (b) (ii) **Channel Availability Check Time:** …

**Additional requirements for the band 5600-5650 MHz**: Until further notice, devices subject to this Section shall not be capable of transmitting in the band 5600-5650 MHz, so that Environment Canada weather radars operating in this band are protected.

RSS-210 Issue 7 A9.4 (b) (iv) **Channel closing time:** the maximum channel closing time is 260 ms.

**FCC**

§15.407 (h) and FCC 06-96 APPENDIX "COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVCIES OPERATING IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION".

**Table 1: Applicability of DFS requirements prior to use of a channel**

| Requirement | Operational Mode | | |
|---|---|---|---|
| | Master | Client (without radar detection) | Client (with radar detection) |
| Non-Occupancy Period | Yes | Not required | Yes |
| DFS Detection Threshold | Yes | Not required | Yes |
| Channel Availability Check Time | Yes | Not required | Not required |
| Uniform Spreading | Yes | Not required | Not required |

**Table 2: Applicability of DFS requirements during normal operation**

| Requirement | Operational Mode | | |
|---|---|---|---|
| | Master | Client **(without DFS)** | Client **(with DFS)** |
| DFS Detection Threshold | Yes | Not required | Yes |
| Channel Closing Transmission Time | Yes | Yes | Yes |
| Channel Move Time | Yes | Yes | Yes |

**Table 3: Interference Threshold values, Master or Client incorporating In-Service Monitoring**

| Maximum Transmit Power | Value (see note) |
|---|---|
| ≥ 200 milliwatt | -64 dBm |
| < 200 milliwatt | -62 dBm |
| Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna<br>Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response. | |

**Table 4: DFS Response requirement values**

| Parameter | Value |
|---|---|
| *Non-occupancy period* | 30 minutes |
| *Channel Availability Check Time* | 60 seconds |
| *Channel Move Time* | 10 seconds |
| *Channel Closing Transmission Time* | 200 milliseconds + approx. 60 milliseconds over remaining 10 second period |
| The instant that the *Channel Move Time* and the *Channel Closing Transmission Time* begins is as follows:<br>For the Short pulse radar Test Signals this instant is the end of the *Burst*.<br>For the Frequency Hopping radar Test Signal, this instant is the end of the last radar burst generated.<br>For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission.<br>The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate channel changes (an aggregate of approximately 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions. | |

**Table 5 – Short Pulse Radar Test Waveforms**

| Radar Type | Pulse Width (Microseconds) | PRI (Microseconds) | Pulses | Minimum Percentage of Successful Detection | Minimum Trials |
|---|---|---|---|---|---|
| 1 | 1 | 1428 | 18 | 60% | 30 |
| 2 | 1-5 | 150-230 | 23-29 | 60% | 30 |
| 3 | 6-10 | 200-500 | 16-18 | 60% | 30 |
| 4 | 11-20 | 200-500 | 12-16 | 60% | 30 |
| Aggregate (Radar Types 1-4) | | | | 80% | 120 |

**Table 6 – Long Pulse Radar Test Signal**

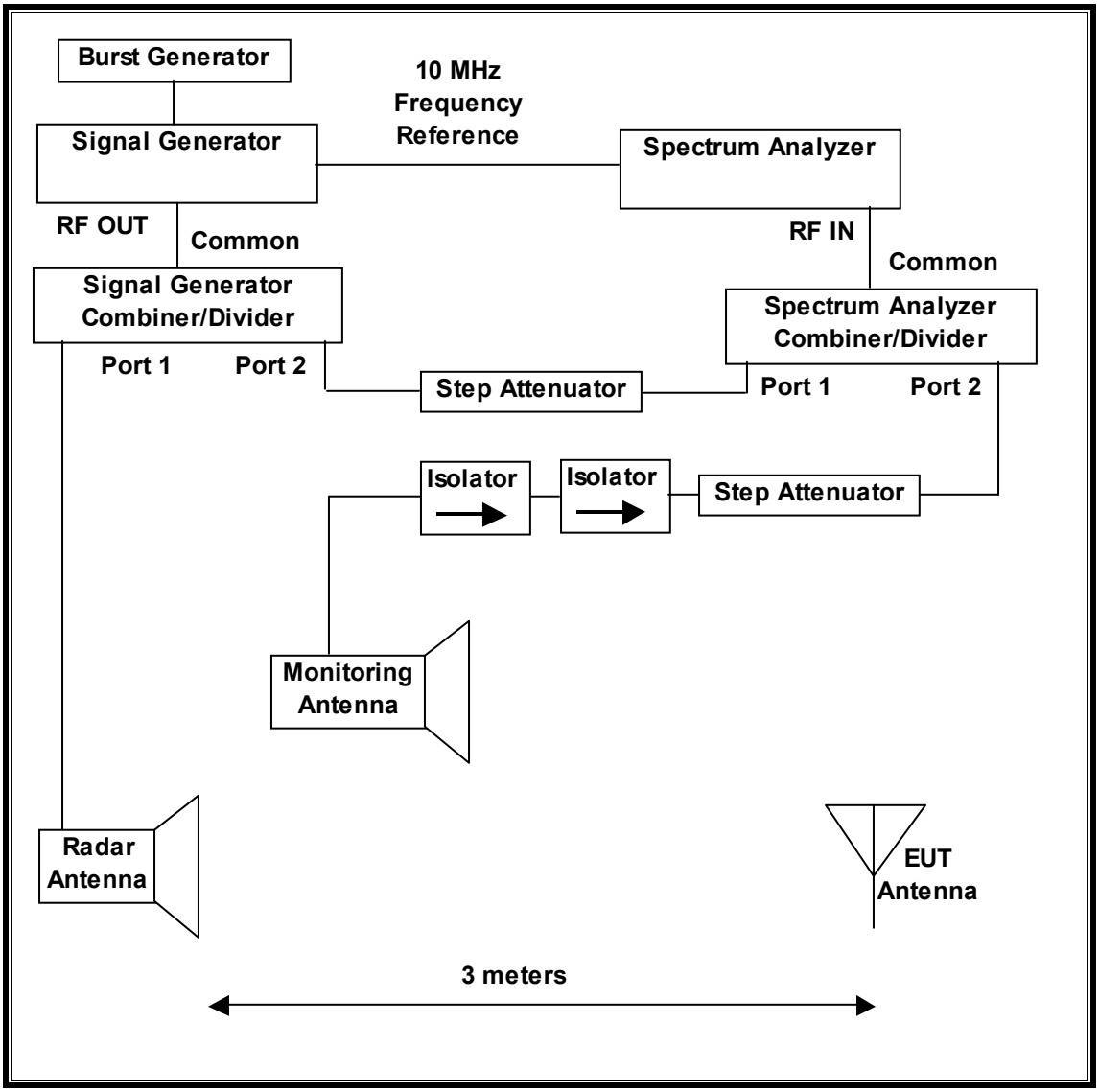
| Radar Waveform | Bursts | Pulses per Burst | Pulse Width (µsec) | Chirp Width (MHz) | PRI (µsec) | Minimum Percentage of Successful Detection | Minimum Trials |
|---|---|---|---|---|---|---|---|
| 5 | 8-20 | 1-3 | 50-100 | 5-20 | 1000-2000 | 80% | 30 |

**Table 7 – Frequency Hopping Radar Test Signal**

| Radar Waveform | Pulse Width (µsec) | PRI (µsec) | Burst Length (ms) | Pulses per Hop | Hopping Rate (kHz) | Minimum Percentage of Successful Detection | Minimum Trials |
|---|---|---|---|---|---|---|---|
| 6 | 1 | 333 | 300 | 9 | .333 | 70% | 30 |

## 10.1.2. TEST AND MEASUREMENT SYSTEM

**RADIATED METHOD SYSTEM BLOCK DIAGRAM**



**SYSTEM OVERVIEW**

The short pulse and long pulse signal generating system utilizes the NTIA software. The Vector Signal Generator has been validated by the NTIA. The hopping signal generating system utilizes the CCS simulated hopping method and system, which has been validated by the DoD, FCC and NTIA. The software selects waveform parameters from within the bounds of the signal type on a random basis using uniform distribution.

The short pulse types 2, 3 and 4, and the long pulse type 5 parameters are randomized at run-time.

The hopping type 6 pulse parameters are fixed while the hopping sequence is based on the August 2005 NTIA Hopping Frequency List. The initial starting point randomized at run-time and each subsequent starting point is incremented by 475. Each frequency in the 100-length segment is compared to the boundaries of the EUT Detection Bandwidth and the software creates a hopping burst pattern in accordance with Section 7.4.1.3 Method #2 Simulated Freqeuncy Hopping Radar Waveform Generating Subsystem of FCC 06-96 APPENDIX. The frequency of the signal generator is incremented in 1 MHz steps from $F_L$ to $F_H$ for each successive trial. This incremental sequence is repeated as required to generate a minimum of 30 total trials and to maintain a uniform frequency distribution over the entire Detection Bandwidth.

The signal monitoring equipment consists of a spectrum analyzer set to display 8001 bins on the horizontal axis. The time-domain resolution is 2 msec / bin with a 16 second sweep time, meeting the 10 second short pulse reporting criteria. The aggregate ON time is calculated by multiplying the number of bins above a threshold during a particular observation period by the dwell time per bin, with the analyzer set to peak detection and max hold.

**SYSTEM CALIBRATION**

A 50-ohm load is connected in place of the spectrum analyzer, and the spectrum analyzer is connected to a horn antenna via a coaxial cable, with the reference level offset set to (horn antenna gain – coaxial cable loss). The signal generator is set to CW mode. The amplitude of the signal generator is adjusted to yield a level of –64 dBm as measured on the spectrum analyzer.

Without changing any of the instrument settings, the spectrum analyzer is reconnected to the Common port of the Spectrum Analyzer Combiner/Divider. Measure the amplitude and calculate the difference from –64 dBm. Adjust the Reference Level Offset of the spectrum analyzer to this difference.

The spectrum analyzer displays the level of the signal generator as received at the antenna ports of the Master Device. The interference detection threshold may be varied from the calibrated value of –64 dBm and the spectrum analyzer will still indicate the level as received by the Master Device.

## ADJUSTMENT OF DISPLAYED TRAFFIC LEVEL

Establish a link between the Master and Slave, adjusting the distance between the units as needed to provide a suitable received level at the Master and Slave devices. Stream the video test file to generate WLAN traffic. Confirm that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold.

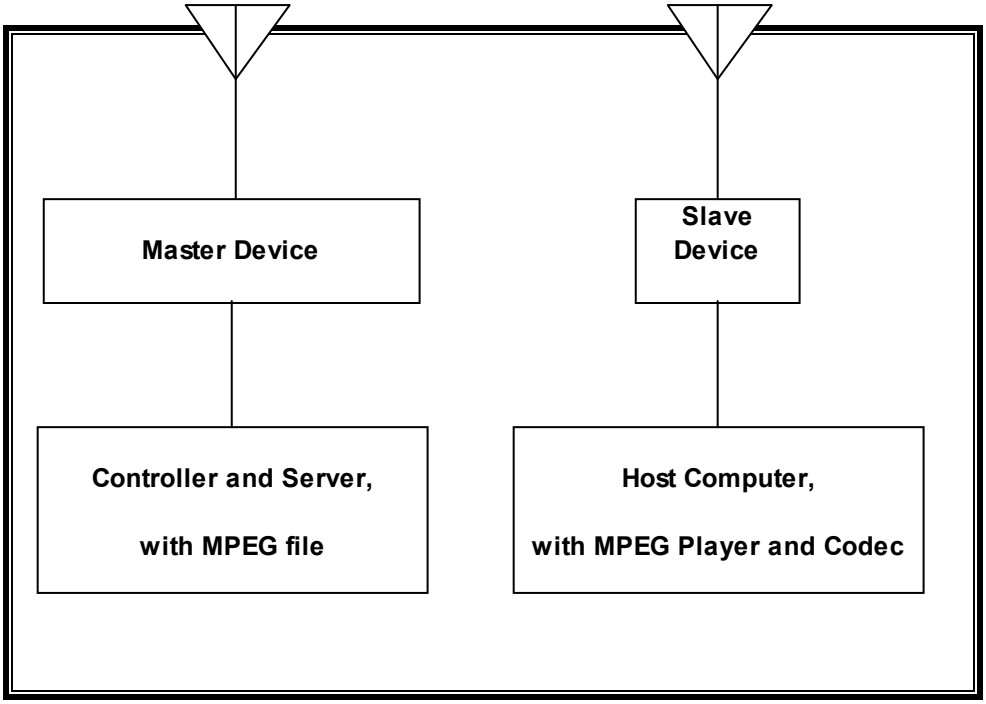
## TEST AND MEASUREMENT EQUIPMENT

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

| TEST EQUIPMENT LIST | | | | |
|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Serial Number** | **Cal Due** |
| Spectrum Analyzer, 26.5 GHz | Agilent / HP | E4407B | C01098 | 02/07/10 |
| Vector signal generator, 20GHz | Agilent / HP | E8267C | C01066 | 11/16/09 |
| Arbitrary Waveform Generator | Agilent / HP | 33220A | C01146 | 05/04/10 |

### 10.1.3. SETUP OF EUT

**RADIATED METHOD EUT TEST SETUP**




**SUPPORT EQUIPMENT**

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

| PERIPHERAL SUPPORT EQUIPMENT LIST | | | | |
|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Serial Number** | **FCC ID** |
| AC Adapter (EUT) | PI Electronics | P030WF120A | 0910000153 | DoC |
| Notebook PC (Host) | HP | Compaq 6710b | CNUL032TY1 | DoC |
| AC Adapter (Host PC) | HP | PA-1900-18HN | 9406310104 | DoC |
| USB to RS-232 Adapter | Keyspan | USA-19HS | 02300 | DoC |
| Notebook PC (Client) | IBM | Type 2668-46U | L3-XDLW 06/02 | DoC |
| AC Adapter (Client PC) | IBM | 02K6749 | 11S02K6749ZJ1 MN328Z9DE | DoC |
| Dual Band Wireless USB Network Adapter (Slave Device) | Linksys/Cisco | WUSB600N | 001C10EB00CB | Q87-WUSB600N |

### 10.1.4. DESCRIPTION OF EUT

The EUT operates over the 5250-5350 MHz and 5470-5725 MHz ranges. For the Canadian version, all channels that have emissions falling within 5600 to 5650 MHz are blocked out.

The EUT is a Master Device.

The highest power level within these bands is 25.15 dBm EIRP in the 5250-5350 MHz band and 26.78 dBm EIRP in the 5470-5725 MHz band.

The only antenna assembly utilized with the EUT has a gain of 3 dBi; in the 802.11a legacy mode it has an effective transmit antenna gain of 6.01 dBi.

Four identical antennas are utilized to meet the diversity and MIMO operational requirement, except in the 802.11a mode where two identical antennas are active for the transmitter and four identical antennas are active for the receiver.

The EUT uses four transmitter/receiver chains, each connected to an antenna to perform radiated tests.

The rated output power of the EUT is > 23dBm (EIRP). Therefore the required interference threshold level is –64 dBm. After correction for antenna gain and procedural adjustments, the required radiated threshold is –64 + 1 = -63 dBm.

The calibrated radiated DFS Detection Threshold level is set to –64 dBm. The tested level is lower than the required level hence it provides margin to the limit.

WLAN traffic is generated by streaming the video file TestFile.mp2 “6 ½ Magic Hours” from the Master to the Slave in full motion video mode using the media player with the V2.61 Codec package.

TPC is not required since the maximum EIRP is less than 500 mW (27 dBm).

The EUT utilizes the 802.11a/n architecture. Two nominal channel bandwidths are implemented: 20 MHz and 40 MHz.

The software installed in the EUT is version 5.0.300.52.

**MANUFACTURER’S STATEMENT REGARDING UNIFORM CHANNEL SPREADING**

This statement is in a separate document.

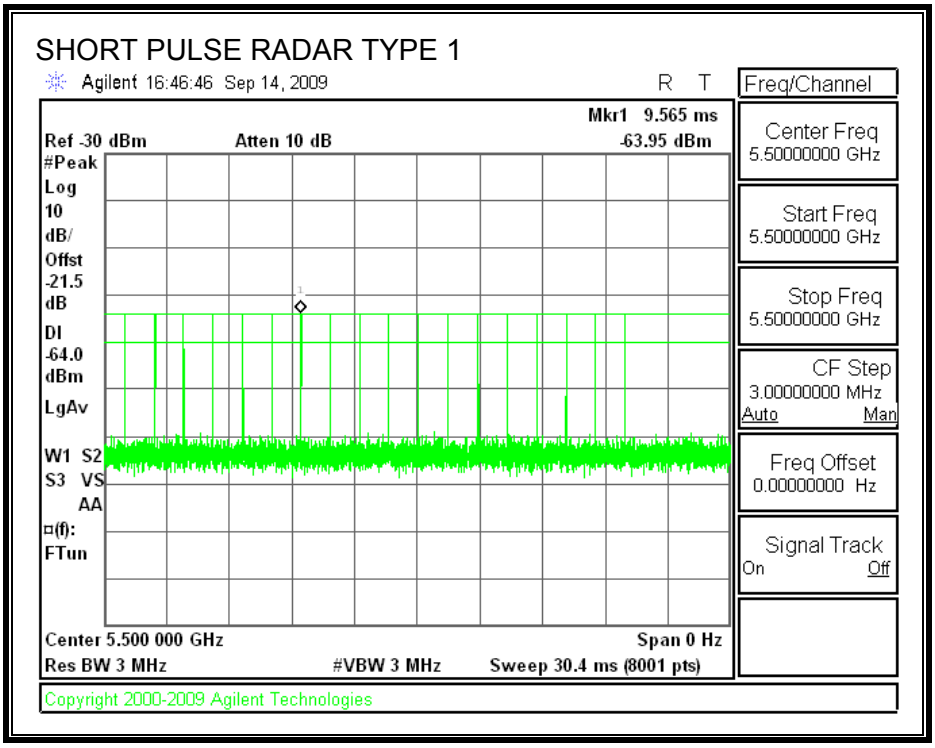
## 10.2. RESULTS FOR 20 MHz BANDWIDTH

### 10.2.1. TEST CHANNEL

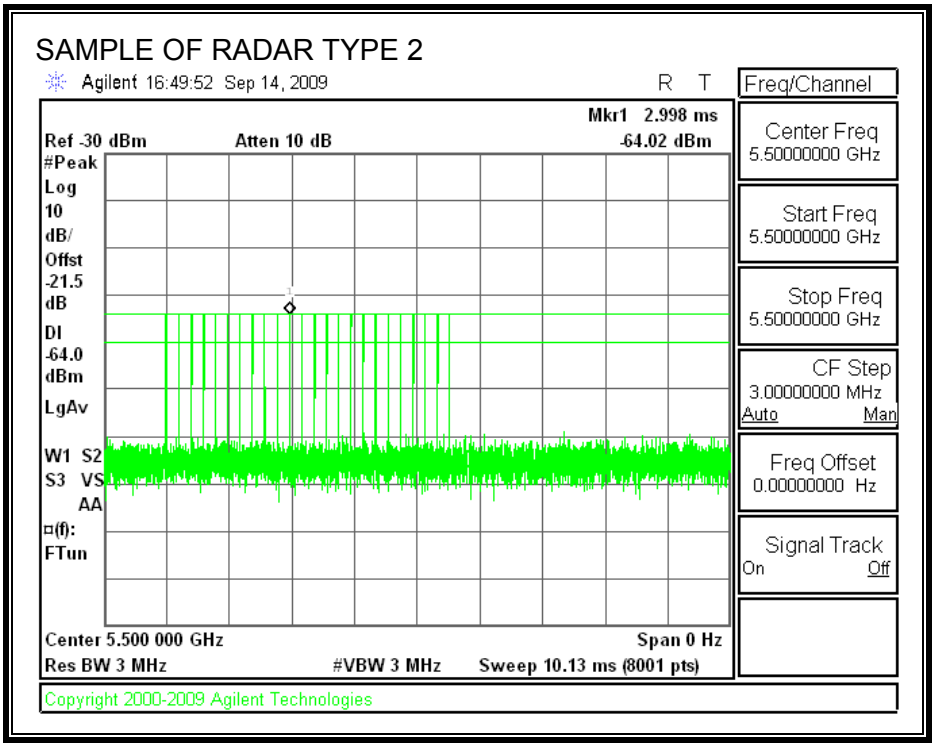
All tests were performed at a channel center frequency of 5500 MHz.

### 10.2.2. PLOTS OF RADAR WAVEFORMS AND WLAN TRAFFIC

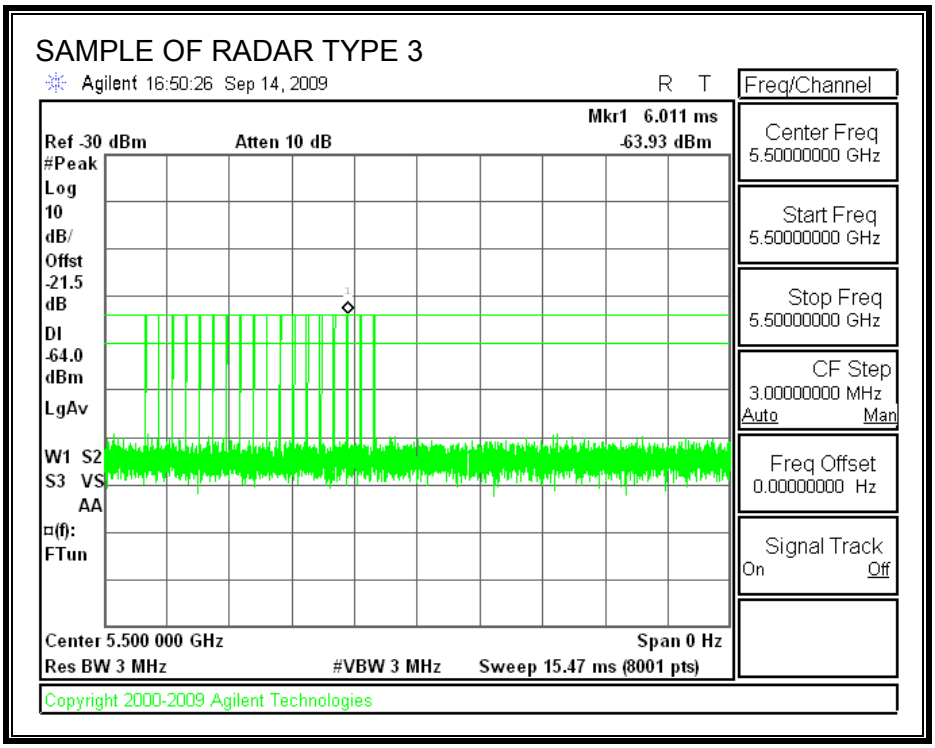
**PLOTS OF RADAR WAVEFORMS**



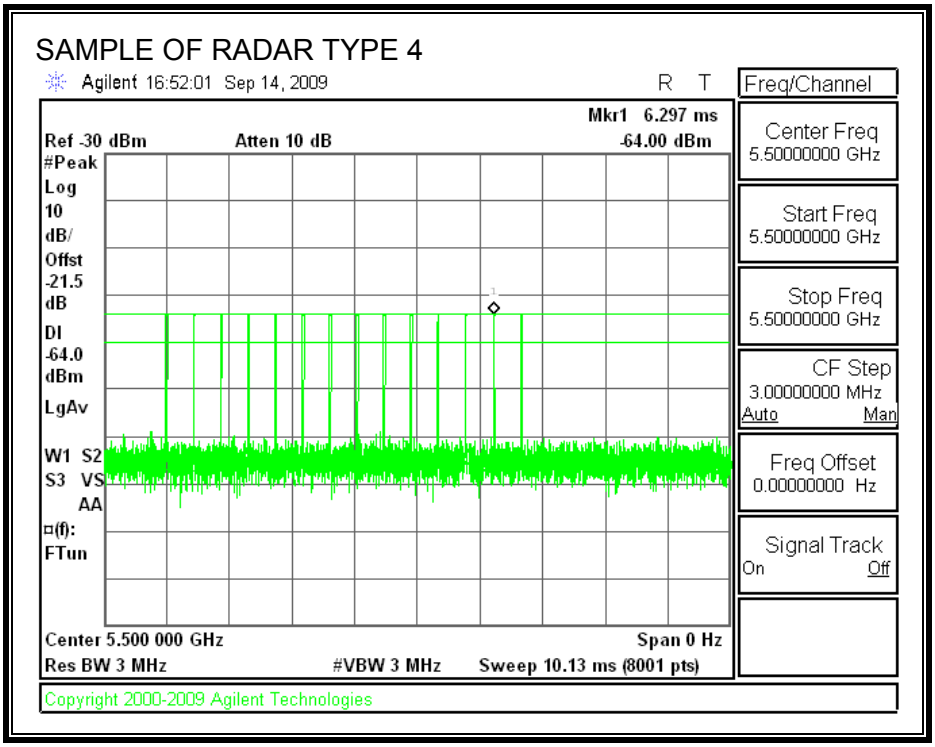
SAMPLE OF RADAR TYPE 2



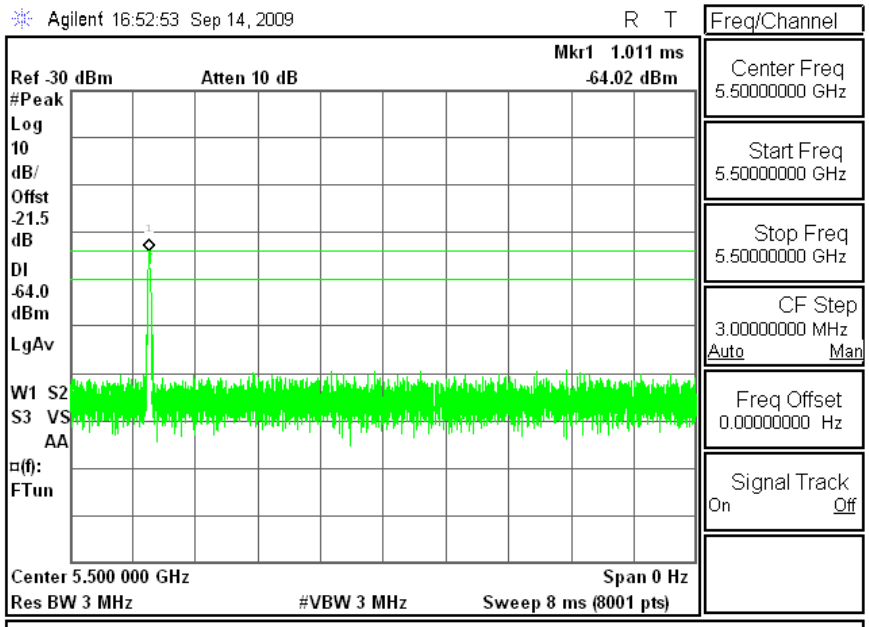
SAMPLE OF RADAR TYPE 3



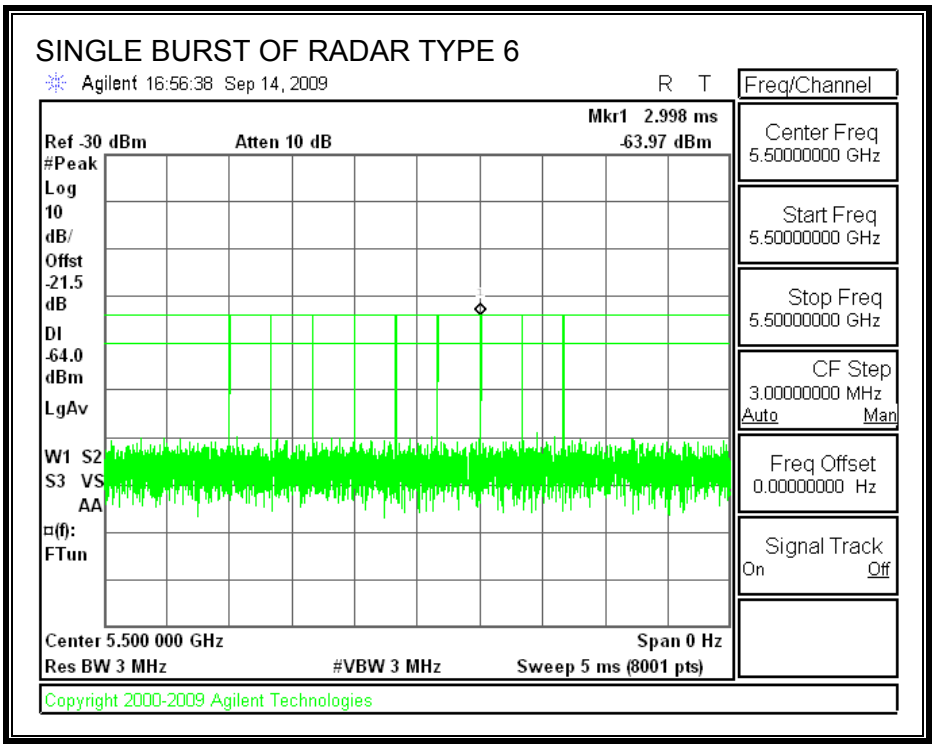
SAMPLE OF RADAR TYPE 4



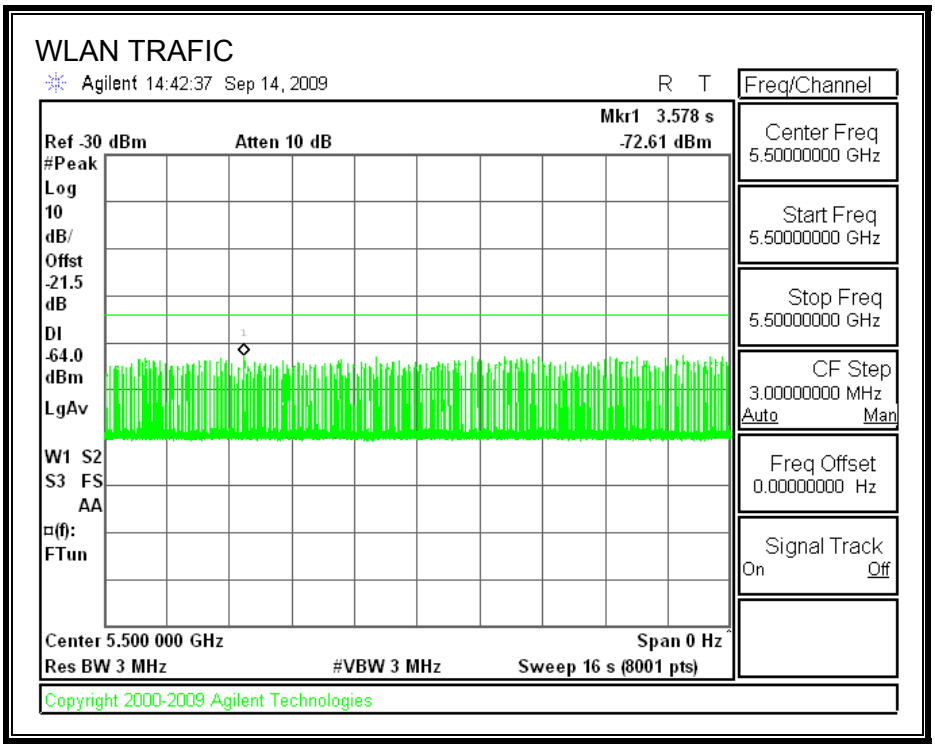
SAMPLE OF SINGLE BURST OF RADAR TYPE 5



SINGLE BURST OF RADAR TYPE 6



**PLOT OF WLAN TRAFFIC FROM MASTER**



### 10.2.3. CHANNEL AVAILABILITY CHECK TIME

**PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME**

A link was established on channel then the EUT was rebooted. The time from the cessation of traffic to the re-initialization of traffic was measured as the time required for the EUT to complete the total power-up cycle. The time to complete the initial power-up period is 60 seconds less than this total power-up time.

**PROCEDURE FOR TIMING OF RADAR BURST**

With a link established on channel, the EUT was rebooted. A radar signal was triggered within 0 to 6 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

The Non-Occupancy list was cleared. With a link established on channel, the EUT was rebooted. A radar signal was triggered within 54 to 60 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

## QUANTITATIVE RESULTS

**No Radar Triggered**

| Timing of Reboot (sec) | Timing of Start of Traffic (sec) | Total Power-up Cycle Time (sec) | Initial Power-up Cycle Time (sec) |
|---|---|---|---|
| 31.12 | 169.3 | 138.2 | 78.2 |

**Radar Near Beginning of CAC**

| Timing of Reboot (sec) | Timing of Radar Burst (sec) | Radar Relative to Reboot (sec) | Radar Relative to Start of CAC (sec) |
|---|---|---|---|
| 30.26 | 110.5 | 80.2 | 2.0 |

**Radar Near End of CAC**

| Timing of Reboot (sec) | Timing of Radar Burst (sec) | Radar Relative to Reboot (sec) | Radar Relative to Start of CAC (sec) |
|---|---|---|---|
| 30 | 167.6 | 137.6 | 59.4 |

## QUALITATIVE RESULTS

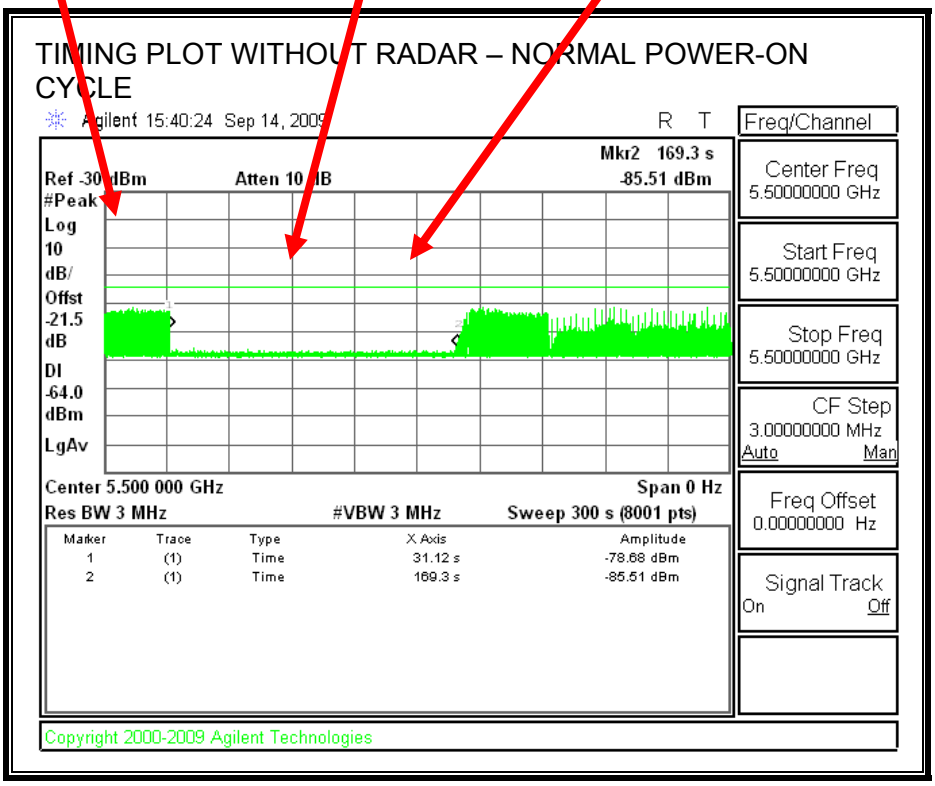
| Timing of Radar Burst | Display on Control Computer | Spectrum Analyzer Display |
|---|---|---|
| No Radar Triggered | EUT marks Channel as active | Transmissions begin on channel after completion of the initial power-up cycle and the CAC |
| Within 0 to 6 second window | EUT indicates radar detected | No transmissions on channel |
| Within 54 to 60 second window | EUT indicates radar detected | No transmissions on channel |

**TIMING PLOT WITHOUT RADAR DURING CAC**

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

End of CAC
Traffic is Initiated



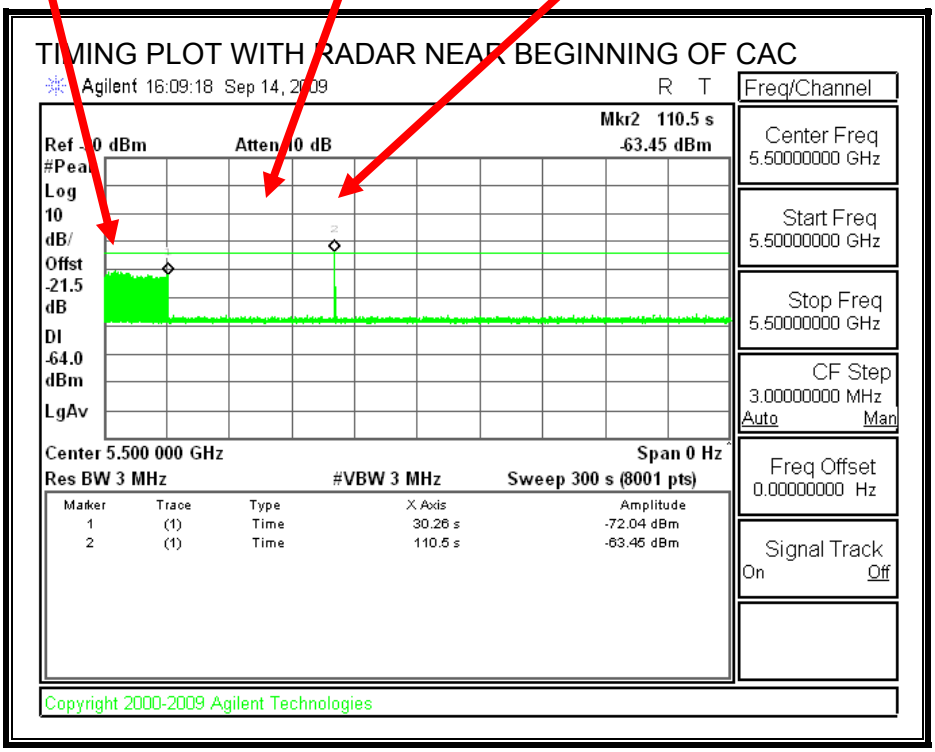

Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

**TIMING PLOT WITH RADAR NEAR BEGINNING OF CAC**

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



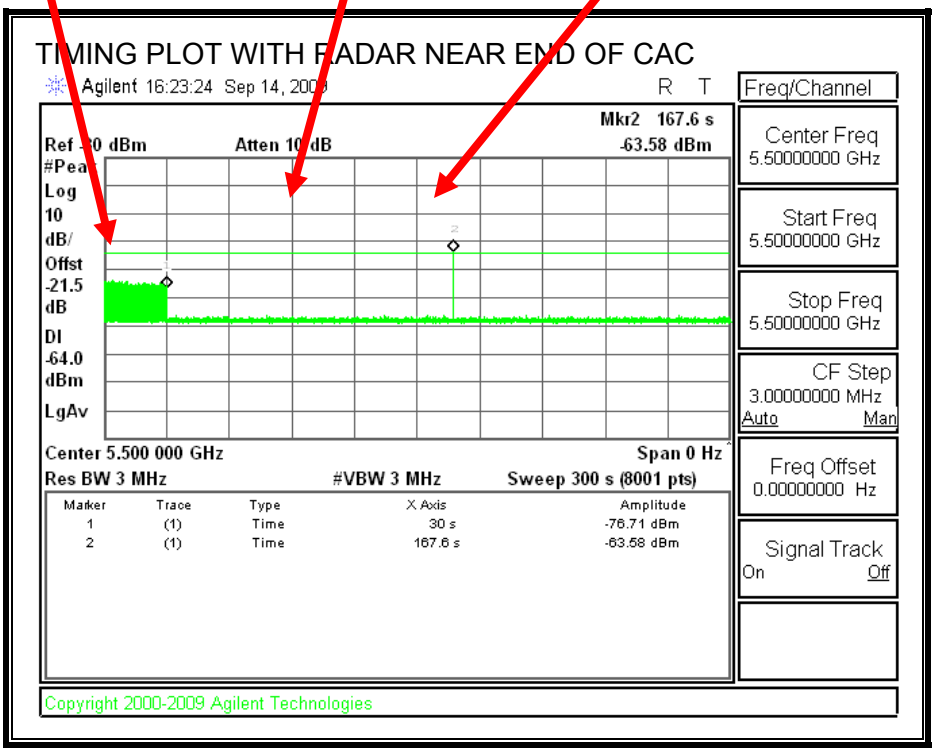

No EUT transmissions were observed after the radar signal.

**TIMING PLOT WITH RADAR NEAR END OF CAC**

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied




No EUT transmissions were observed after the radar signal.

### 10.2.4. OVERLAPPING CHANNEL TESTS

**RESULTS**

These tests are not applicable.

### 10.2.5. MOVE AND CLOSING TIME

**REPORTING NOTES**

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =
(Number of analyzer bins showing transmission) * (dwell time per bin)

The observation period over which the FCC aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

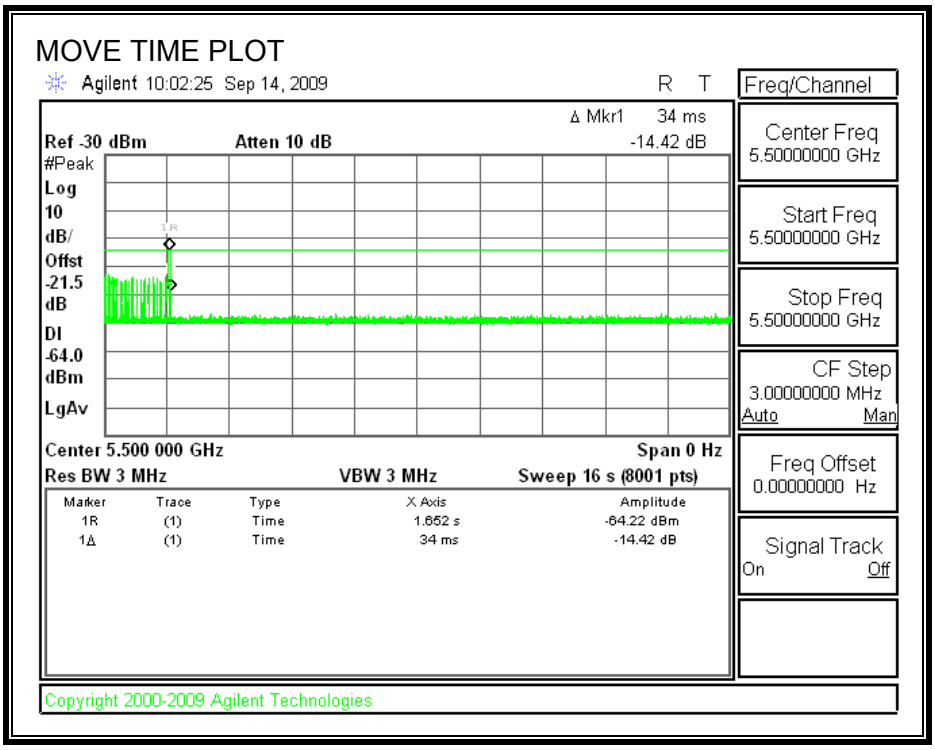
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

**RESULTS**

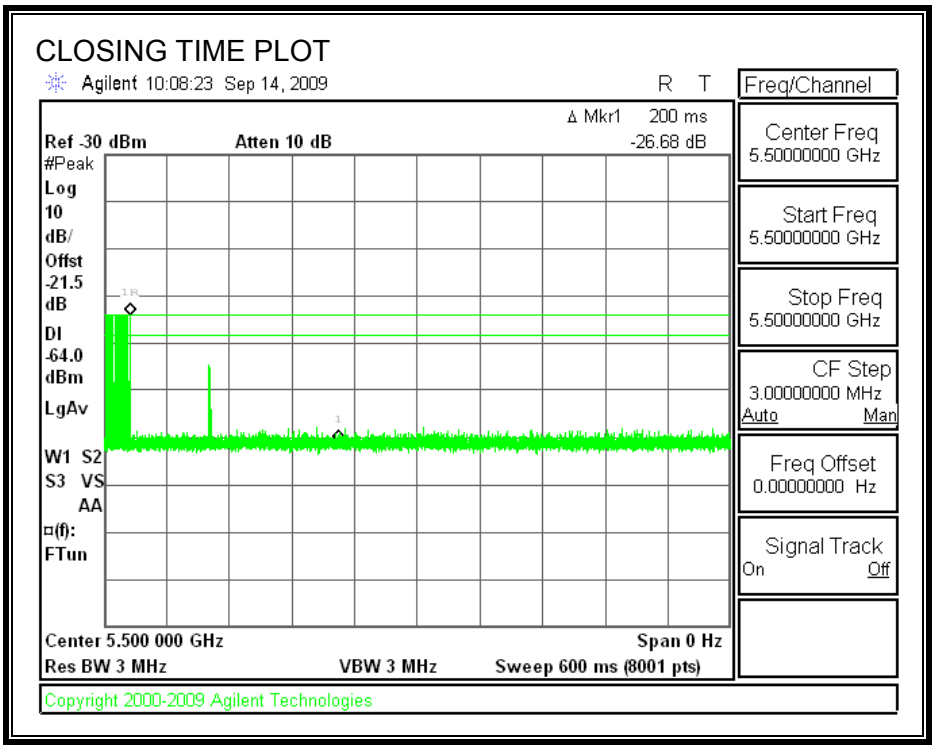
| Agency | Channel Move Time (sec) | Limit (sec) |
|---|---|---|
| FCC / IC | 0.034 | 10 |

| Agency | Aggregate Channel Closing Transmission Time (msec) | Limit (msec) |
|---|---|---|
| FCC | 0.0 | 60 |
| IC | 4.0 | 260 |

**MOVE TIME**



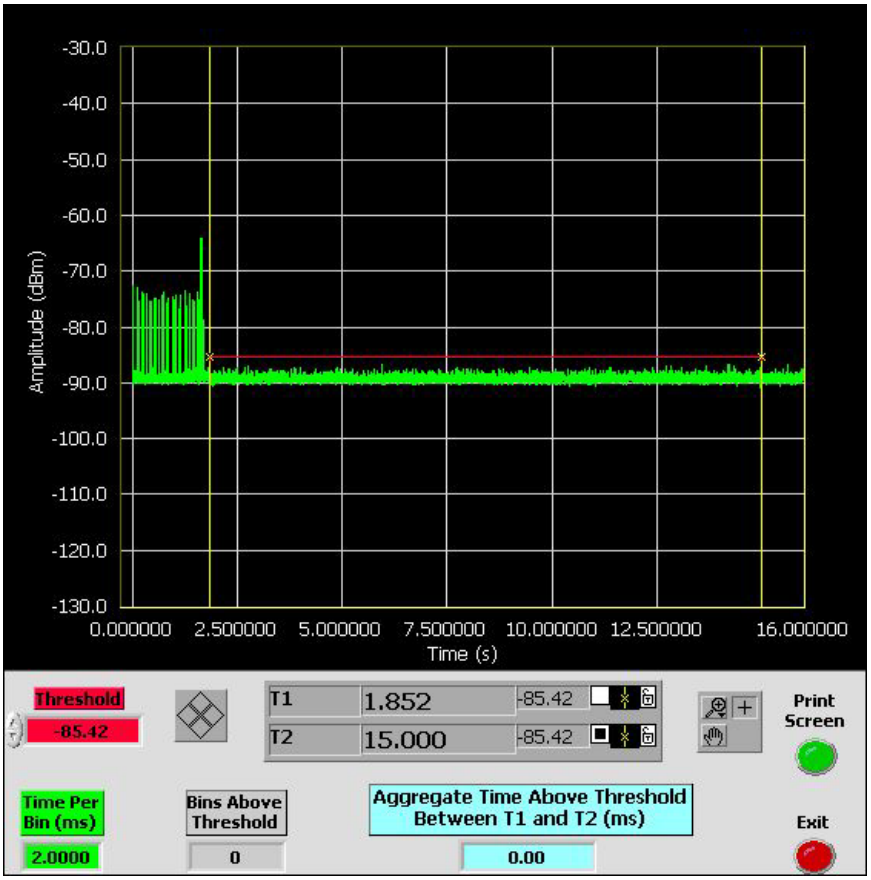
**CHANNEL CLOSING TIME**



**AGGREGATE CHANNEL CLOSING TRANSMISSION TIME**

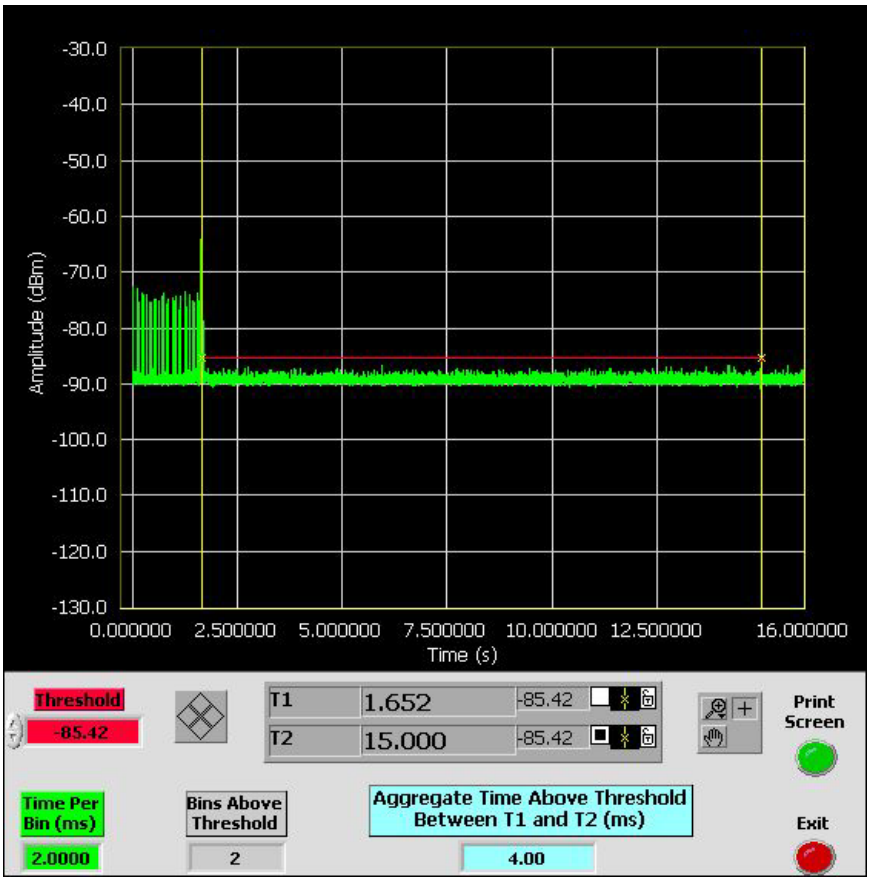
No transmissions are observed during the FCC aggregate monitoring period.

FCC AGGREGATE CLOSING TIME PLOT



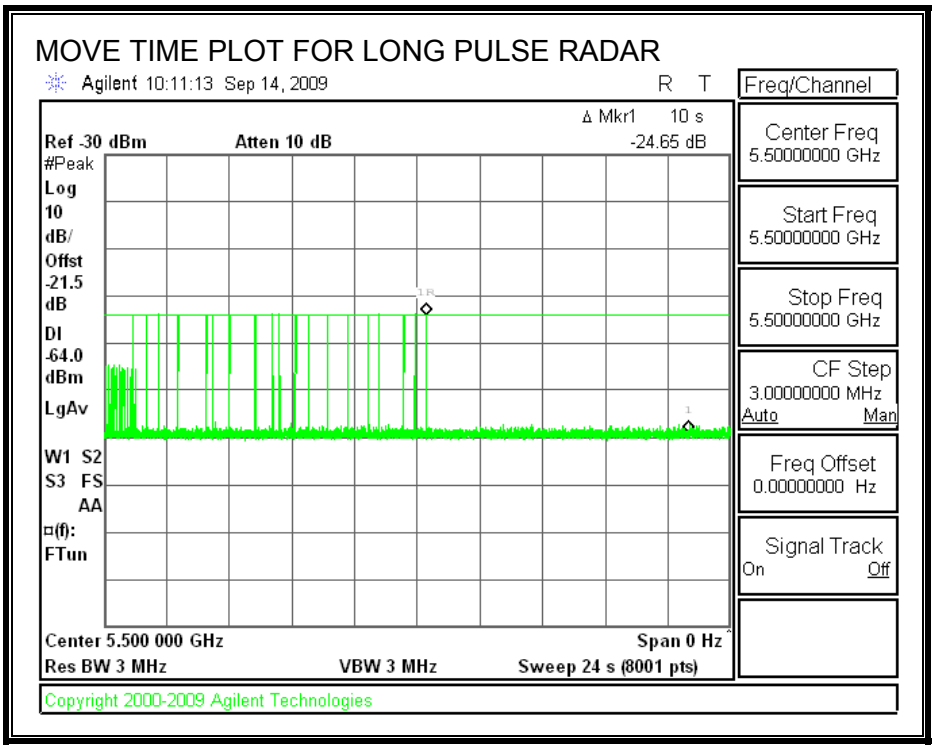
Only intermittent transmissions are observed during the IC aggregate monitoring period.

IC AGGREGATE CLOSING TIME PLOT



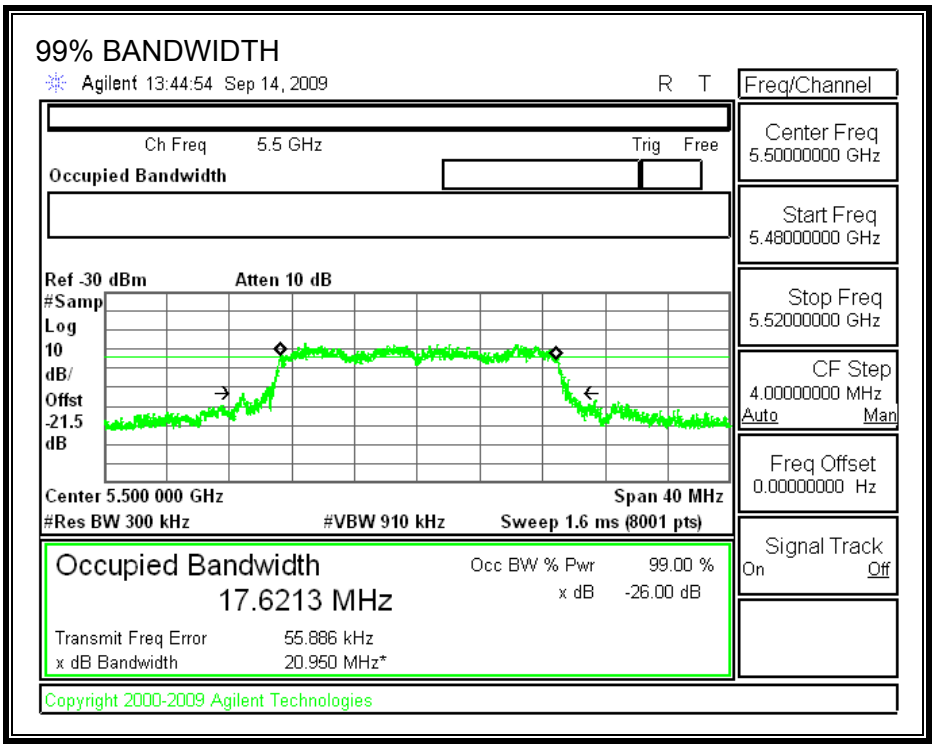
**LONG PULSE CHANNEL MOVE TIME**

The traffic ceases prior to 10 seconds after the end of the radar waveform.



## 10.2.6. DETECTION BANDWIDTH

**REFERENCE PLOT OF 99% POWER BANDWIDTH**




**RESULTS**

| FL (MHz) | FH (MHz) | Detection Bandwidth (MHz) | 99% Power Bandwidth (MHz) | Ratio of Detection BW to 99% Power BW (%) | Minimum Limit (%) |
|---|---|---|---|---|---|
| 5492 | 5508 | 16 | 17.621 | 90.8 | 80 |

**DETECTION BANDWIDTH PROBABILITY**

DETECTION BANDWIDTH PROBABILITY RESULTS

| Detection Bandwidth Test Results | | | | |
|---|---|---|---|---|
| FCC Type 1 Waveform: 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst | | | | |
| Frequency (MHz) | Number of Trials | Number Detected | Detection (%) | Mark |
| 5492 | 10 | 10 | 100 | FL |
| 5493 | 10 | 10 | 100 | |
| 5494 | 10 | 10 | 100 | |
| 5495 | 10 | 10 | 100 | |
| 5496 | 10 | 10 | 100 | |
| 5497 | 10 | 9 | 90 | |
| 5498 | 10 | 9 | 90 | |
| 5499 | 10 | 10 | 100 | |
| 5500 | 10 | 10 | 100 | |
| 5501 | 10 | 10 | 100 | |
| 5502 | 10 | 10 | 100 | |
| 5503 | 10 | 10 | 100 | |
| 5504 | 10 | 9 | 90 | |
| 5505 | 10 | 10 | 100 | |
| 5506 | 10 | 10 | 100 | |
| 5507 | 10 | 10 | 100 | |
| 5508 | 10 | 10 | 100 | FH |

## 10.2.7. IN-SERVICE MONITORING

**RESULTS**

| FCC Radar Test Summary | | | | |
|---|---|---|---|---|
| Signal Type | Number of Trials | Detection (%) | Limit (%) | Pass/Fail |
| FCC Short Pulse Type 1 | 30 | 90.00 | 60 | Pass |
| FCC Short Pulse Type 2 | 30 | 90.00 | 60 | Pass |
| FCC Short Pulse Type 3 | 30 | 86.67 | 60 | Pass |
| FCC Short Pulse Type 4 | 30 | 90.00 | 60 | Pass |
| Aggregate | | 89.17 | 80 | Pass |
| FCC Long Pulse Type 5 | 30 | 93.33 | 80 | Pass |
| FCC Hopping Type 6 | 35 | 97.14 | 70 | Pass |

**TYPE 1 DETECTION PROBABILITY**

| Data Sheet for FCC Short Pulse Radar Type 1 | |
|---|---|
| 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst | |
| Trial | Successful Detection (Yes/No) |
| 1 | Yes |
| 2 | Yes |
| 3 | Yes |
| 4 | Yes |
| 5 | Yes |
| 6 | No |
| 7 | Yes |
| 8 | Yes |
| 9 | Yes |
| 10 | Yes |
| 11 | Yes |
| 12 | Yes |
| 13 | Yes |
| 14 | Yes |
| 15 | Yes |
| 16 | Yes |
| 17 | No |
| 18 | Yes |
| 19 | Yes |
| 20 | Yes |
| 21 | Yes |
| 22 | Yes |
| 23 | Yes |
| 24 | Yes |
| 25 | Yes |
| 26 | Yes |
| 27 | Yes |
| 28 | Yes |
| 29 | Yes |
| 30 | Yes |

**TYPE 2 DETECTION PROBABILITY**

| Data Sheet for FCC Short Pulse Radar Type 2 | | | | |
|---|---|---|---|---|
| Waveform | Pulse Width (us) | PRI (us) | Pulses Per Burst | Successful Detection (Yes/No) |
| 2001 | 1.7 | 200.00 | 24 | Yes |
| 2002 | 2 | 198.00 | 23 | Yes |
| 2003 | 3.8 | 153.00 | 25 | Yes |
| 2004 | 2.5 | 210.00 | 28 | Yes |
| 2005 | 1.3 | 171.00 | 28 | Yes |
| 2006 | 2.5 | 173.00 | 27 | Yes |
| 2007 | 1.9 | 207.00 | 28 | Yes |
| 2008 | 2.4 | 195.00 | 24 | Yes |
| 2009 | 2.2 | 185.00 | 27 | Yes |
| 2010 | 1.6 | 188.00 | 27 | Yes |
| 2011 | 1.3 | 169.00 | 29 | Yes |
| 2012 | 3.2 | 199.00 | 29 | Yes |
| 2013 | 1.4 | 210.00 | 23 | Yes |
| 2014 | 1.2 | 169.00 | 27 | Yes |
| 2015 | 3.1 | 213.00 | 29 | Yes |
| 2016 | 4.5 | 213.00 | 23 | Yes |
| 2017 | 3.7 | 206.00 | 28 | Yes |
| 2018 | 3.1 | 212.00 | 29 | Yes |
| 2019 | 2.5 | 186.00 | 23 | No |
| 2020 | 2.8 | 215.00 | 28 | Yes |
| 2021 | 1 | 208.00 | 24 | Yes |
| 2022 | 4.3 | 168.00 | 27 | Yes |
| 2023 | 2.2 | 163.00 | 24 | Yes |
| 2024 | 3.7 | 216.00 | 28 | Yes |
| 2025 | 2.9 | 210.00 | 23 | Yes |
| 2026 | 4.5 | 206.00 | 26 | Yes |
| 2027 | 3.9 | 193.00 | 29 | Yes |
| 2028 | 2.4 | 230.00 | 29 | Yes |
| 2029 | 1 | 203.00 | 27 | Yes |
| 2030 | 3.6 | 208.00 | 27 | Yes |

**TYPE 3 DETECTION PROBABILITY**

| Data Sheet for FCC Short Pulse Radar Type 3 | | | | |
|---|---|---|---|---|
| Waveform | Pulse Width (us) | PRI (us) | Pulses Per Burst | Successful Detection (Yes/No) |
| 3001 | 5.9 | 334.00 | 18 | Yes |
| 3002 | 7.5 | 368.00 | 16 | Yes |
| 3003 | 5.6 | 405.00 | 18 | Yes |
| 3004 | 7 | 311.00 | 17 | Yes |
| 3005 | 6.4 | 473.00 | 17 | Yes |
| 3006 | 6.2 | 469.00 | 17 | Yes |
| 3007 | 9.1 | 355.00 | 17 | Yes |
| 3008 | 6.3 | 334.00 | 18 | Yes |
| 3009 | 9.5 | 421.00 | 17 | Yes |
| 3010 | 5.6 | 462.00 | 16 | Yes |
| 3011 | 9.8 | 252.00 | 17 | No |
| 3012 | 5.3 | 364.00 | 16 | Yes |
| 3013 | 7.3 | 381.00 | 17 | Yes |
| 3014 | 9.2 | 483.00 | 17 | No |
| 3015 | 9.2 | 310.00 | 16 | Yes |
| 3016 | 5.9 | 430.00 | 16 | Yes |
| 3017 | 7.7 | 326.00 | 17 | Yes |
| 3018 | 6.1 | 413.00 | 17 | Yes |
| 3019 | 8.1 | 453.00 | 16 | Yes |
| 3020 | 6.3 | 416.00 | 18 | Yes |
| 3021 | 8.3 | 271.00 | 18 | Yes |
| 3022 | 7.7 | 288.00 | 16 | Yes |
| 3023 | 8 | 451.00 | 17 | Yes |
| 3024 | 8.3 | 459.00 | 17 | Yes |
| 3025 | 8.5 | 310.00 | 17 | Yes |
| 3026 | 8.8 | 393.00 | 16 | Yes |
| 3027 | 9.1 | 256.00 | 17 | Yes |
| 3028 | 5.2 | 275.00 | 16 | Yes |
| 3029 | 6.3 | 374 | 18 | Yes |
| 3030 | 7.6 | 392 | 16 | Yes |

**TYPE 4 DETECTION PROBABILITY**

| Data Sheet for FCC Short Pulse Radar Type 4 | | | | |
|---|---|---|---|---|
| Waveform | Pulse Width (us) | PRI (us) | Pulses Per Burst | Successful Detection (Yes/No) |
| 4001 | 16.7 | 441.00 | 14 | Yes |
| 4002 | 12.2 | 305.00 | 13 | Yes |
| 4003 | 16.5 | 396.00 | 13 | Yes |
| 4004 | 13.3 | 485.00 | 12 | Yes |
| 4005 | 17.2 | 472.00 | 15 | Yes |
| 4006 | 16.9 | 308.00 | 13 | Yes |
| 4007 | 16.1 | 368.00 | 12 | Yes |
| 4008 | 18.1 | 373.00 | 13 | Yes |
| 4009 | 19.2 | 288.00 | 12 | Yes |
| 4010 | 18.8 | 353.00 | 13 | Yes |
| 4011 | 17.3 | 312.00 | 15 | Yes |
| 4012 | 16.3 | 481.00 | 12 | Yes |
| 4013 | 15.2 | 490.00 | 12 | Yes |
| 4014 | 17.7 | 361.00 | 14 | Yes |
| 4015 | 10.6 | 279.00 | 16 | Yes |
| 4016 | 11.1 | 346.00 | 14 | Yes |
| 4017 | 17 | 332.00 | 15 | Yes |
| 4018 | 11.6 | 300.00 | 15 | Yes |
| 4019 | 12.3 | 455.00 | 12 | Yes |
| 4020 | 19.1 | 279.00 | 15 | Yes |
| 4021 | 15.7 | 433.00 | 14 | Yes |
| 4022 | 20 | 381.00 | 15 | Yes |
| 4023 | 11.8 | 332.00 | 14 | Yes |
| 4024 | 14.6 | 265.00 | 14 | Yes |
| 4025 | 19.9 | 306.00 | 16 | Yes |
| 4026 | 15.3 | 327.00 | 15 | Yes |
| 4027 | 11.1 | 260.00 | 15 | Yes |
| 4028 | 13.9 | 356.00 | 13 | Yes |
| 4029 | 11.9 | 260.00 | 15 | No |
| 4030 | 17.9 | 444.00 | 12 | Yes |

**TYPE 5 DETECTION PROBABILITY**

| Data Sheet for FCC Long Pulse Radar Type 5 | |
|---|---|
| Trial | Successful Detection (Yes/No) |
| 1 | Yes |
| 2 | Yes |
| 3 | Yes |
| 4 | Yes |
| 5 | Yes |
| 6 | Yes |
| 7 | Yes |
| 8 | Yes |
| 9 | Yes |
| 10 | Yes |
| 11 | Yes |
| 12 | Yes |
| 13 | Yes |
| 14 | Yes |
| 15 | Yes |
| 16 | Yes |
| 17 | No |
| 18 | Yes |
| 19 | Yes |
| 20 | Yes |
| 21 | Yes |
| 22 | Yes |
| 23 | Yes |
| 24 | Yes |
| 25 | Yes |
| 26 | Yes |
| 27 | Yes |
| 28 | Yes |
| 29 | Yes |
| 30 | Yes |

Note: The Type 5 randomized parameters are shown in a separate document.

**TYPE 6 DETECTION PROBABILITY**

| Data Sheet for FCC Hopping Radar Type 6 | | | | |
|---|---|---|---|---|
| 1 us Pulse Width, 333 us PRI, 9 Pulses per Burst, 1 Burst per Hop | | | | |
| NTIA August 2005 Hopping Sequence | | | | |
| Trial | Starting Index Within Sequence | Signal Generator Frequency (MHz) | Hops within Detection BW | Successful Detection (Yes/No) |
| 1 | 354 | 5492 | 1 | Yes |
| 2 | 829 | 5493 | 2 | Yes |
| 3 | 1304 | 5494 | 7 | Yes |
| 4 | 1779 | 5495 | 7 | Yes |
| 5 | 2254 | 5496 | 4 | Yes |
| 6 | 2729 | 5497 | 1 | Yes |
| 7 | 3679 | 5498 | 4 | Yes |
| 8 | 4154 | 5499 | 4 | Yes |
| 9 | 4629 | 5500 | 2 | Yes |
| 10 | 5104 | 5501 | 2 | Yes |
| 11 | 5579 | 5502 | 4 | Yes |
| 12 | 6529 | 5503 | 5 | Yes |
| 13 | 7004 | 5504 | 2 | Yes |
| 14 | 7479 | 5505 | 3 | Yes |
| 15 | 7954 | 5506 | 2 | Yes |
| 16 | 8429 | 5507 | 3 | Yes |
| 17 | 8904 | 5508 | 5 | Yes |
| 18 | 9379 | 5492 | 6 | Yes |
| 19 | 9854 | 5493 | 2 | Yes |
| 20 | 10329 | 5494 | 5 | Yes |
| 21 | 10804 | 5495 | 6 | Yes |
| 22 | 11279 | 5496 | 5 | Yes |
| 23 | 11754 | 5497 | 2 | Yes |
| 24 | 12229 | 5498 | 1 | Yes |
| 25 | 12704 | 5499 | 2 | Yes |
| 26 | 13179 | 5500 | 3 | Yes |
| 27 | 13654 | 5501 | 1 | Yes |
| 28 | 14129 | 5502 | 4 | Yes |
| 29 | 14604 | 5503 | 4 | Yes |
| 30 | 15079 | 5504 | 4 | Yes |
| 31 | 15554 | 5505 | 2 | Yes |
| 32 | 16029 | 5506 | 5 | Yes |
| 33 | 16504 | 5507 | 6 | Yes |
| 34 | 16979 | 5508 | 4 | Yes |

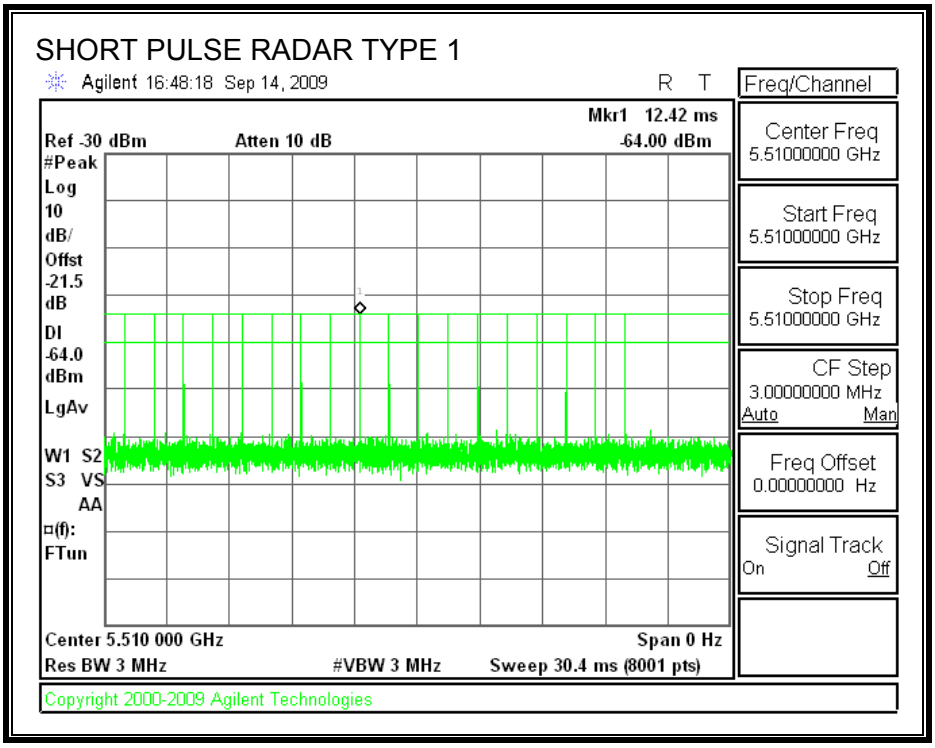
## 10.3. RESULTS FOR 40 MHz BANDWIDTH

### 10.3.1. TEST CHANNEL

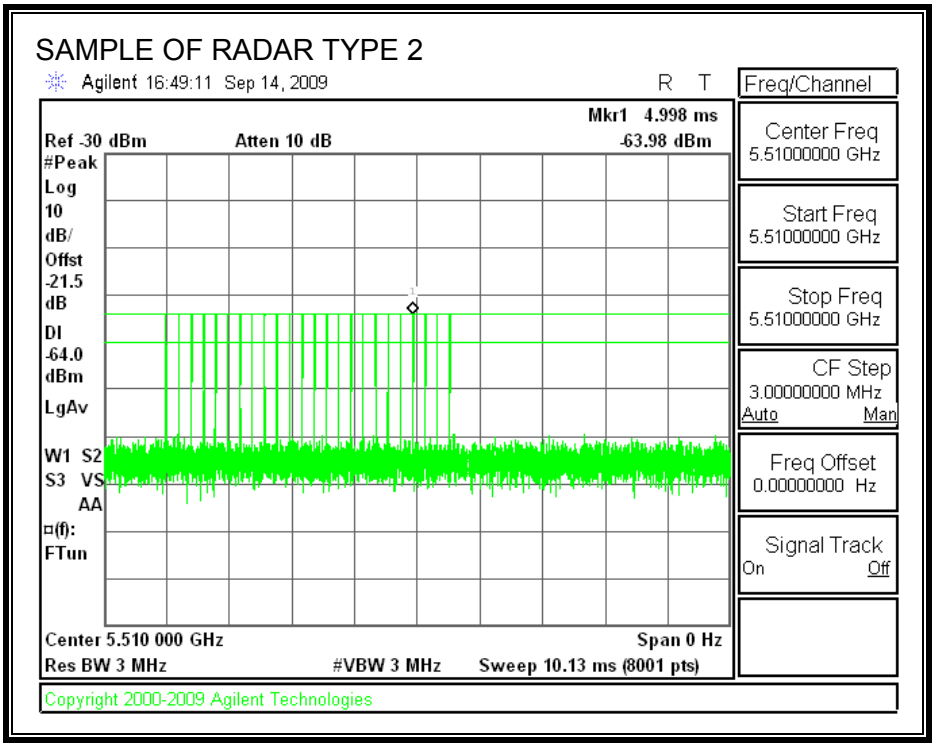
All tests were performed at a channel center frequency of 5510 MHz.

### 10.3.2. PLOTS OF RADAR WAVEFORMS AND WLAN TRAFFIC

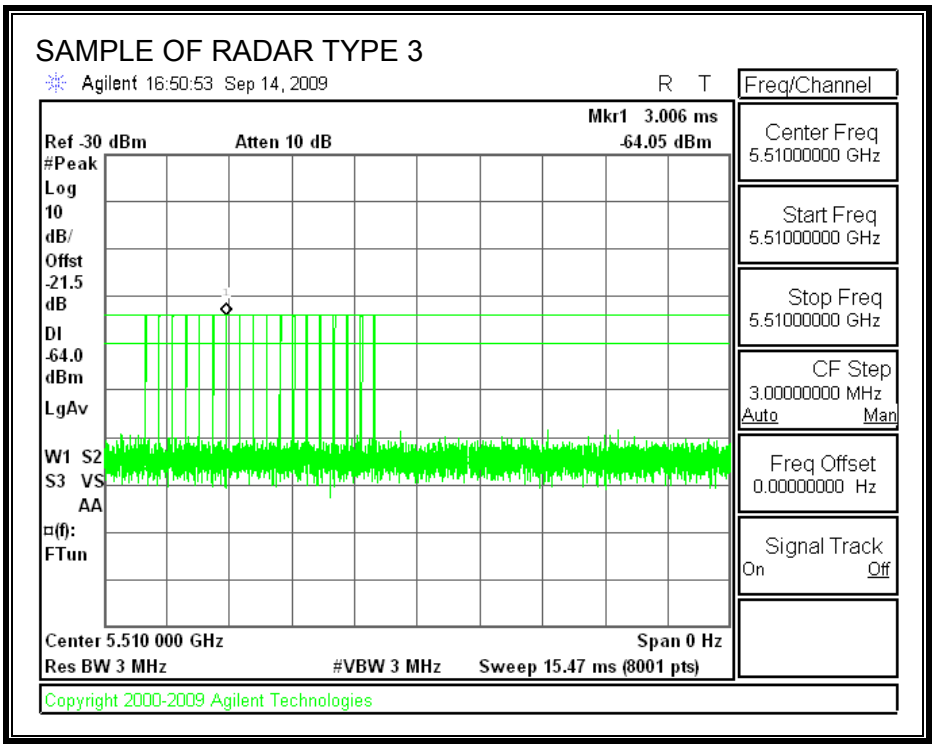
**PLOTS OF RADAR WAVEFORMS**



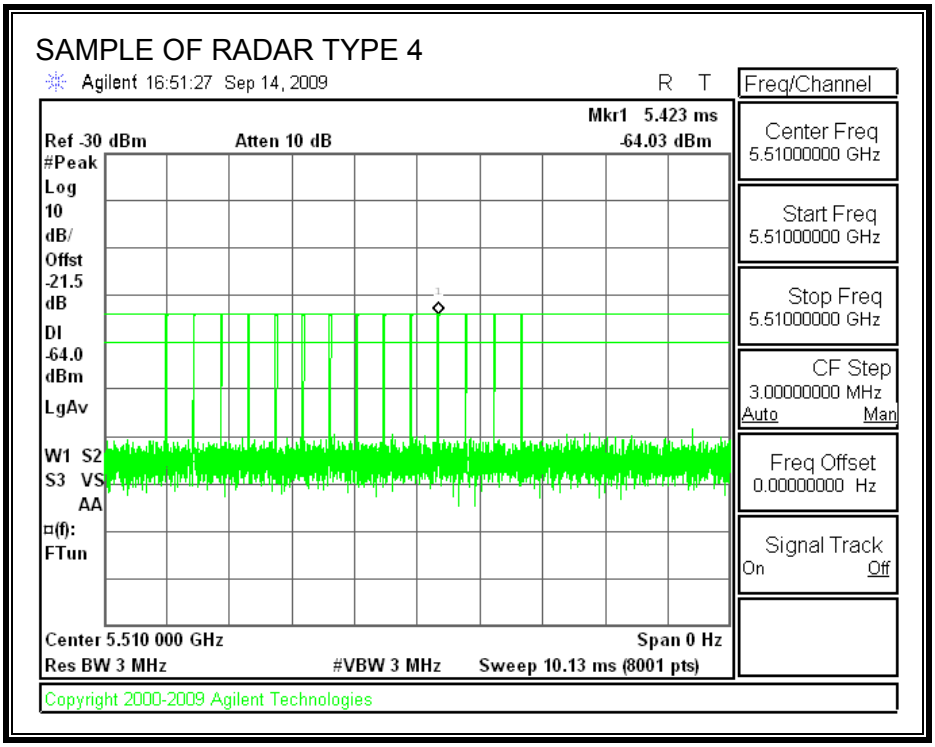
SAMPLE OF RADAR TYPE 2



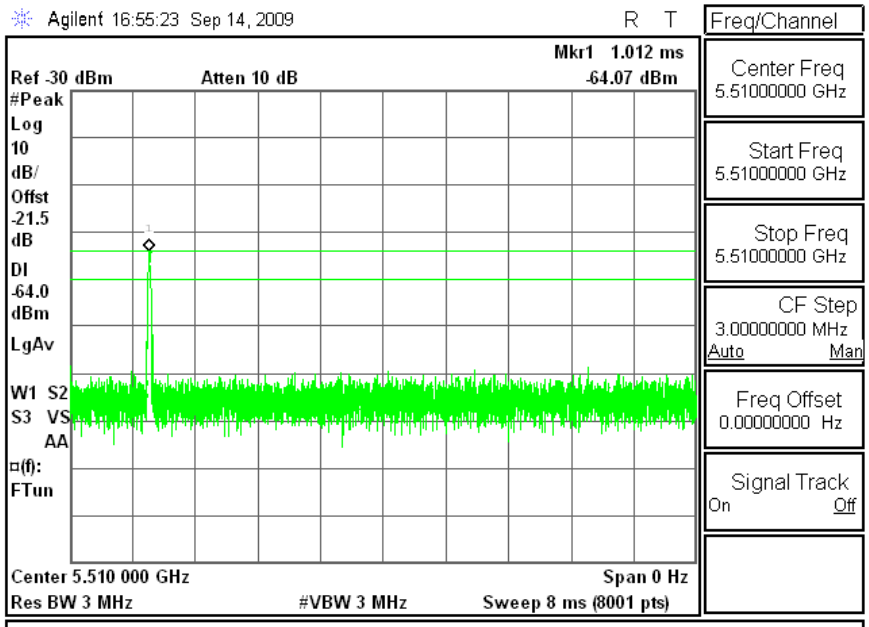
SAMPLE OF RADAR TYPE 3

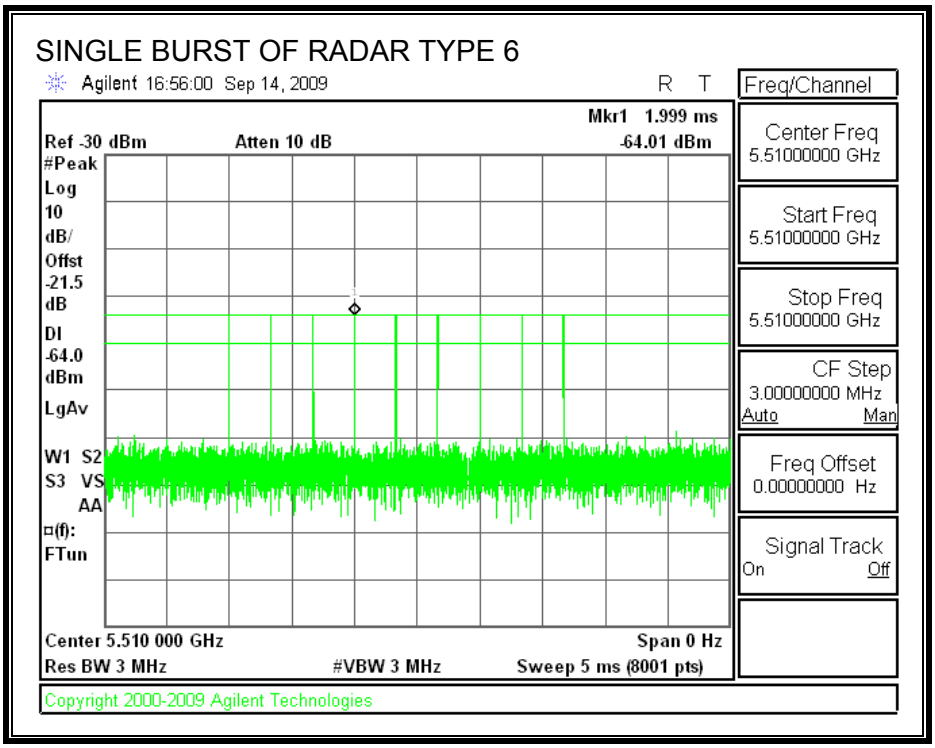


SAMPLE OF RADAR TYPE 4

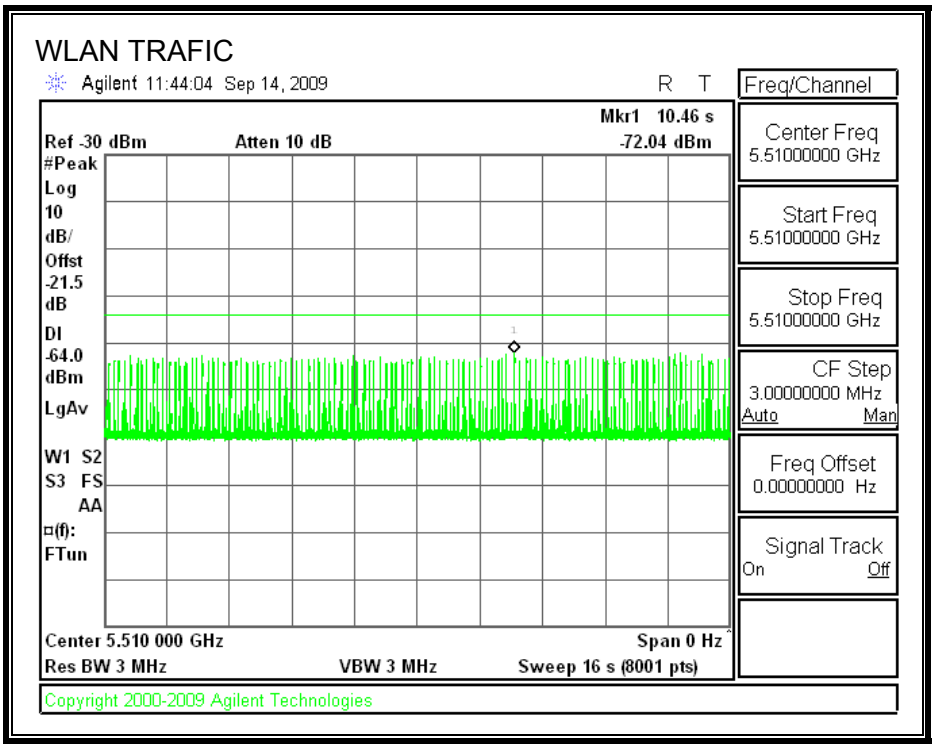


SAMPLE OF SINGLE BURST OF RADAR TYPE 5





**PLOT OF WLAN TRAFFIC FROM MASTER**



### 10.3.3. CHANNEL AVAILABILITY CHECK TIME

**PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME**

A link was established on channel then the EUT was rebooted. The time from the cessation of traffic to the re-initialization of traffic was measured as the time required for the EUT to complete the total power-up cycle. The time to complete the initial power-up period is 60 seconds less than this total power-up time.

**PROCEDURE FOR TIMING OF RADAR BURST**

With a link established on channel, the EUT was rebooted. A radar signal was triggered within 0 to 6 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

The Non-Occupancy list was cleared. With a link established on channel, the EUT was rebooted. A radar signal was triggered within 54 to 60 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

## QUANTITATIVE RESULTS

**No Radar Triggered**

| Timing of Reboot (sec) | Timing of Start of Traffic (sec) | Total Power-up Cycle Time (sec) | Initial Power-up Cycle Time (sec) |
|---|---|---|---|
| 29.81 | 169.5 | 139.7 | 79.7 |

**Radar Near Beginning of CAC**

| Timing of Reboot (sec) | Timing of Radar Burst (sec) | Radar Relative to Reboot (sec) | Radar Relative to Start of CAC (sec) |
|---|---|---|---|
| 30.15 | 111.2 | 81.1 | 1.4 |

**Radar Near End of CAC**

| Timing of Reboot (sec) | Timing of Radar Burst (sec) | Radar Relative to Reboot (sec) | Radar Relative to Start of CAC (sec) |
|---|---|---|---|
| 30.23 | 168.8 | 138.6 | 58.9 |

## QUALITATIVE RESULTS

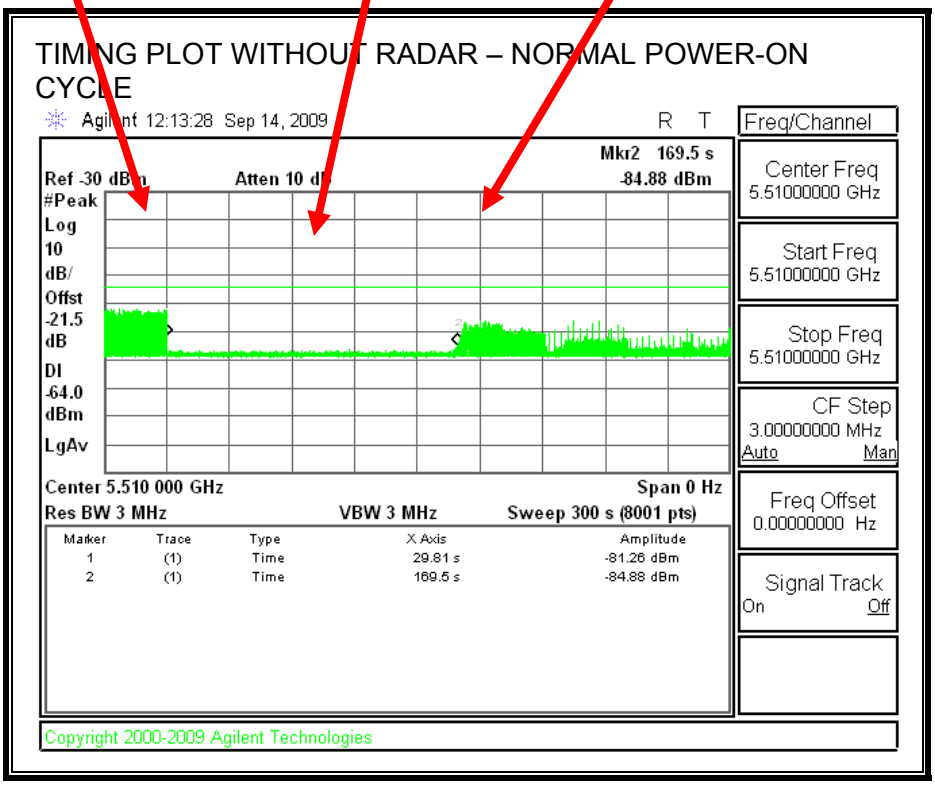
| Timing of Radar Burst | Display on Control Computer | Spectrum Analyzer Display |
|---|---|---|
| No Radar Triggered | EUT marks Channel as active | Transmissions begin on channel after completion of the initial power-up cycle and the CAC |
| Within 0 to 6 second window | EUT indicates radar detected | No transmissions on channel |
| Within 54 to 60 second window | EUT indicates radar detected | No transmissions on channel |

**TIMING PLOT WITHOUT RADAR DURING CAC**

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

End of CAC
Traffic is Initiated



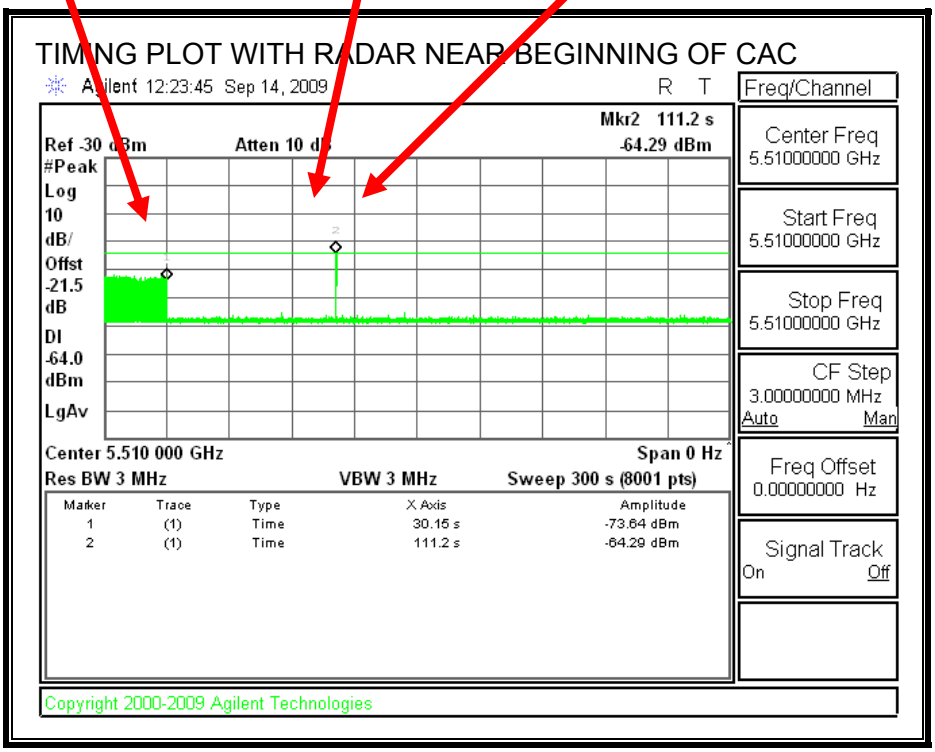

Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

**TIMING PLOT WITH RADAR NEAR BEGINNING OF CAC**

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



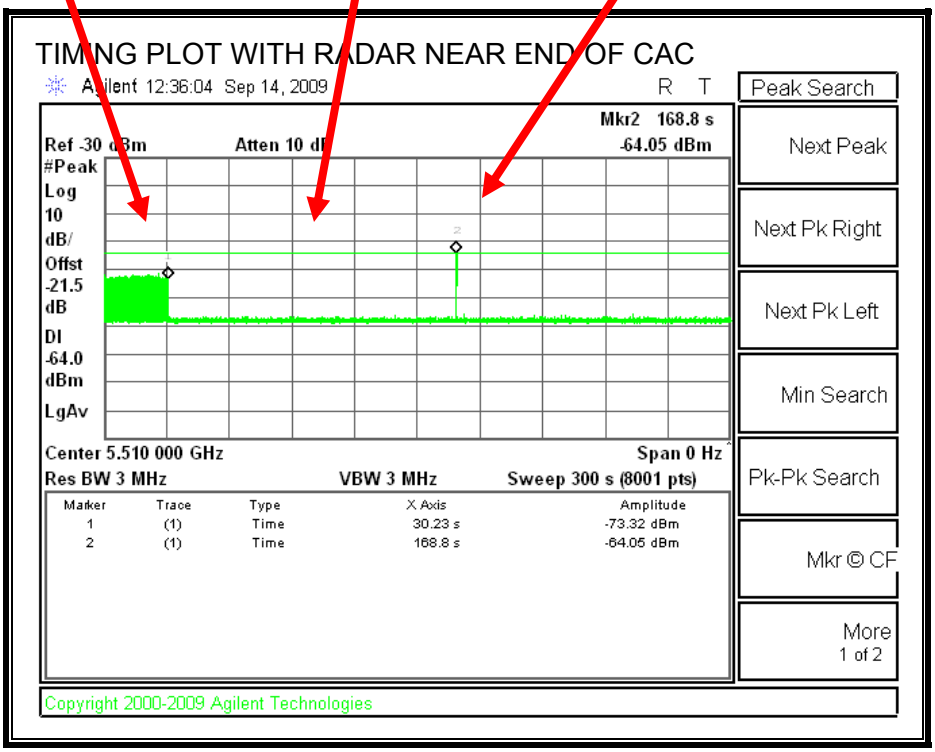

No EUT transmissions were observed after the radar signal.

**TIMING PLOT WITH RADAR NEAR END OF CAC**

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied




No EUT transmissions were observed after the radar signal.

### 10.3.4. OVERLAPPING CHANNEL TESTS

**RESULTS**

These tests are not applicable.

### 10.3.5. MOVE AND CLOSING TIME

**REPORTING NOTES**

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =
(Number of analyzer bins showing transmission) * (dwell time per bin)

The observation period over which the FCC aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

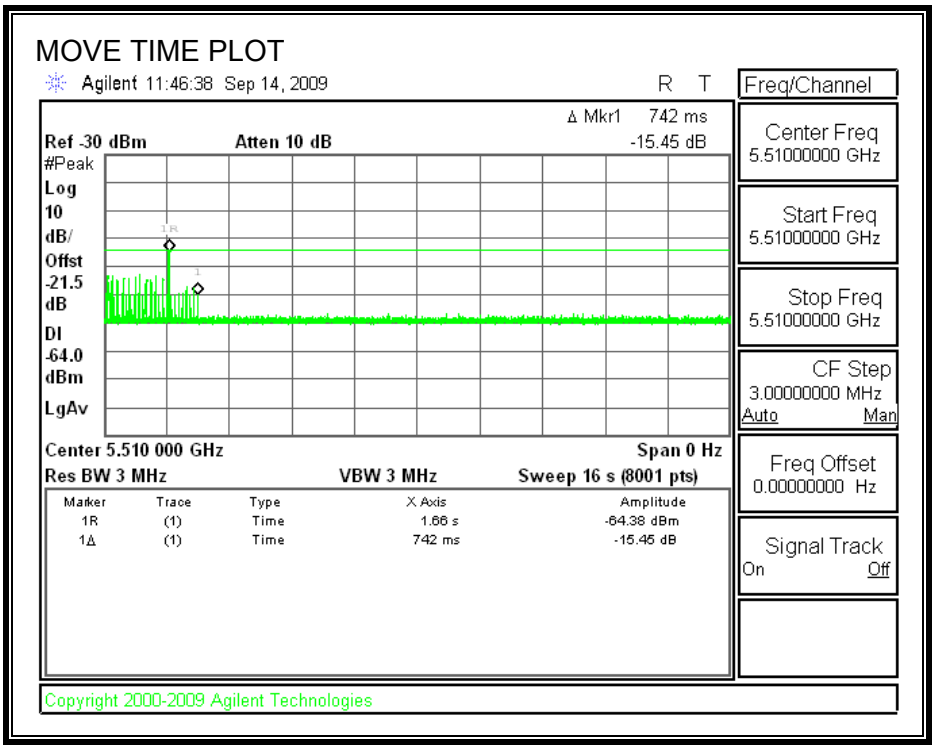
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

**RESULTS**

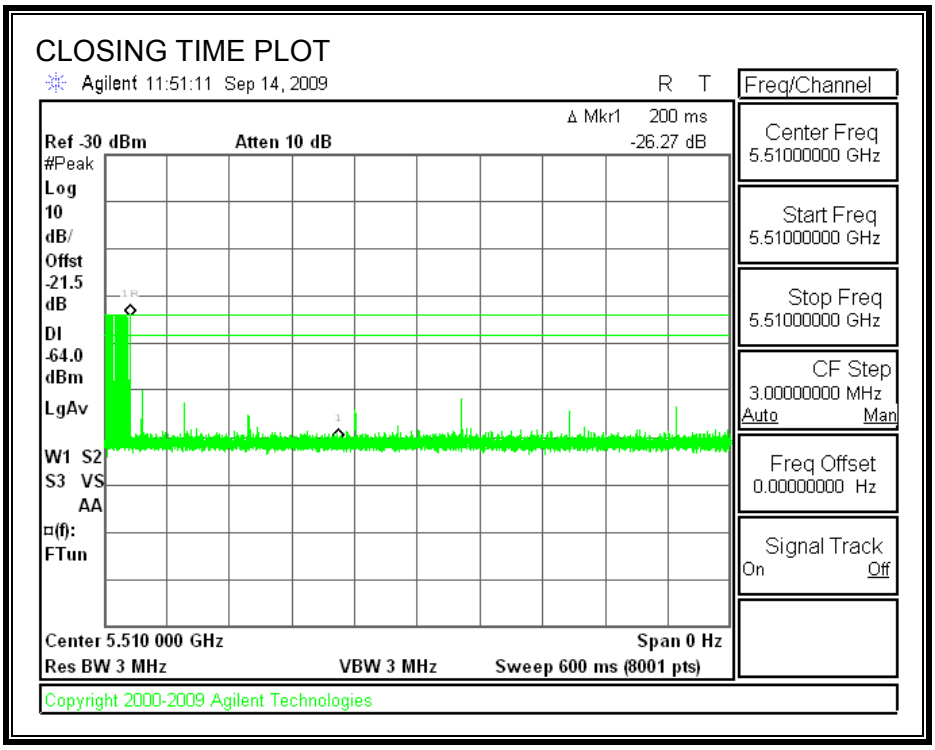
| Agency | Channel Move Time (sec) | Limit (sec) |
|---|---|---|
| FCC / IC | 0.742 | 10 |

| Agency | Aggregate Channel Closing Transmission Time (msec) | Limit (msec) |
|---|---|---|
| FCC | 14.0 | 60 |
| IC | 18.0 | 260 |

**MOVE TIME**



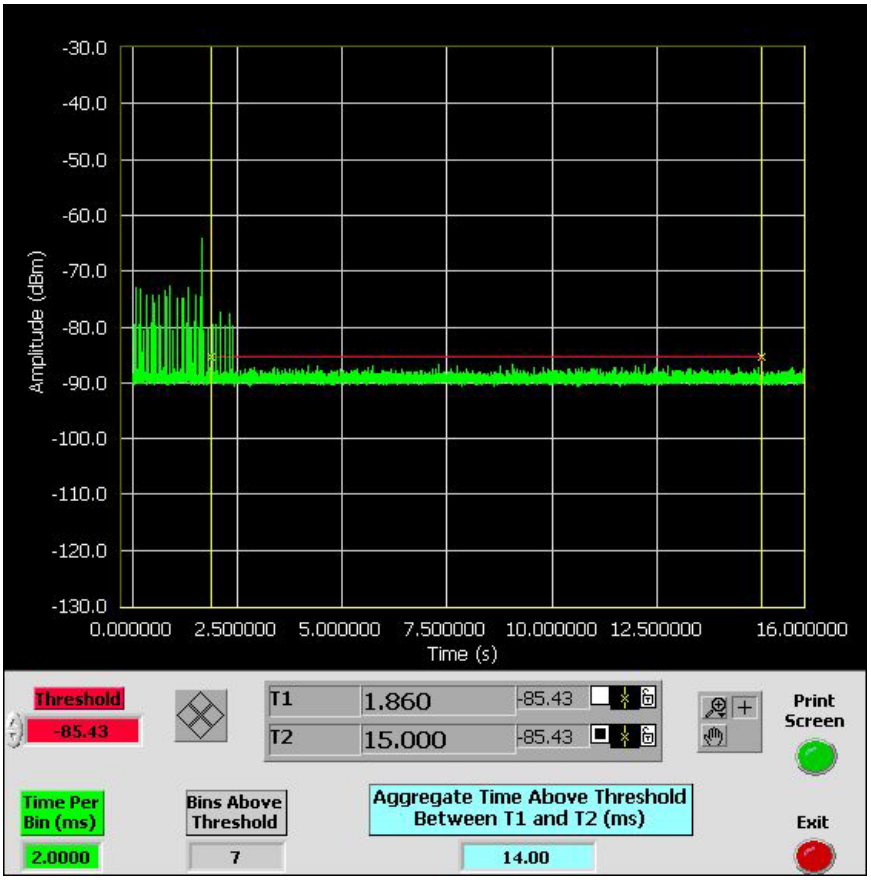
**CHANNEL CLOSING TIME**



**AGGREGATE CHANNEL CLOSING TRANSMISSION TIME**

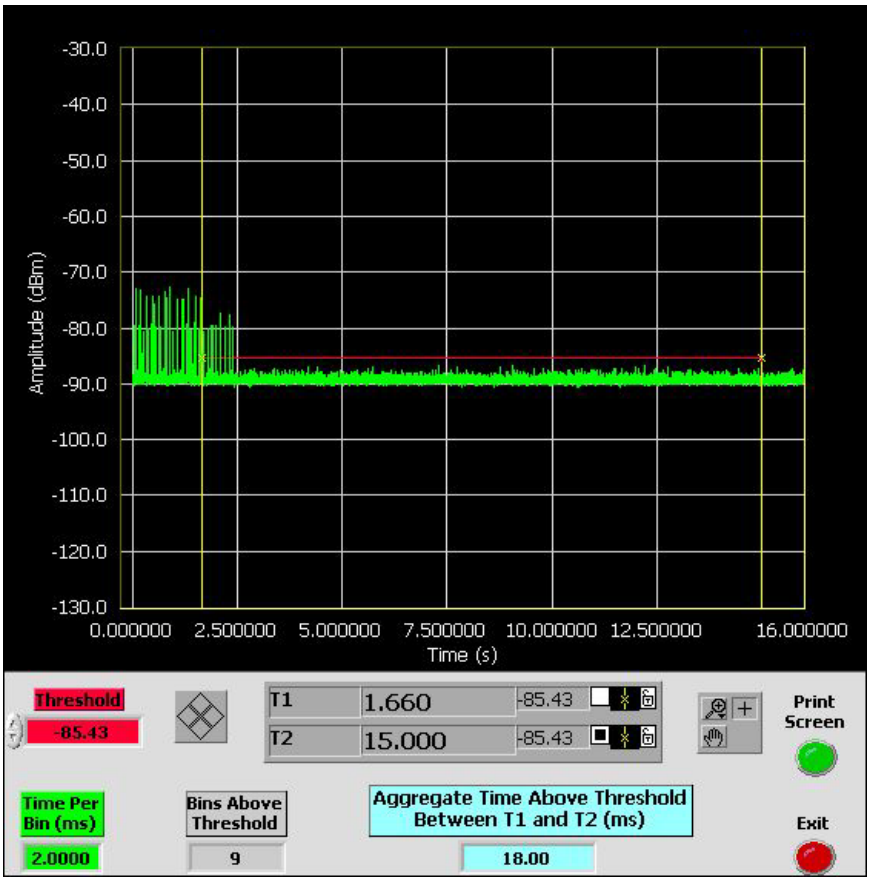
Only intermittent transmissions are observed during the FCC aggregate monitoring period.

FCC AGGREGATE CLOSING TIME PLOT



Only intermittent transmissions are observed during the IC aggregate monitoring period.

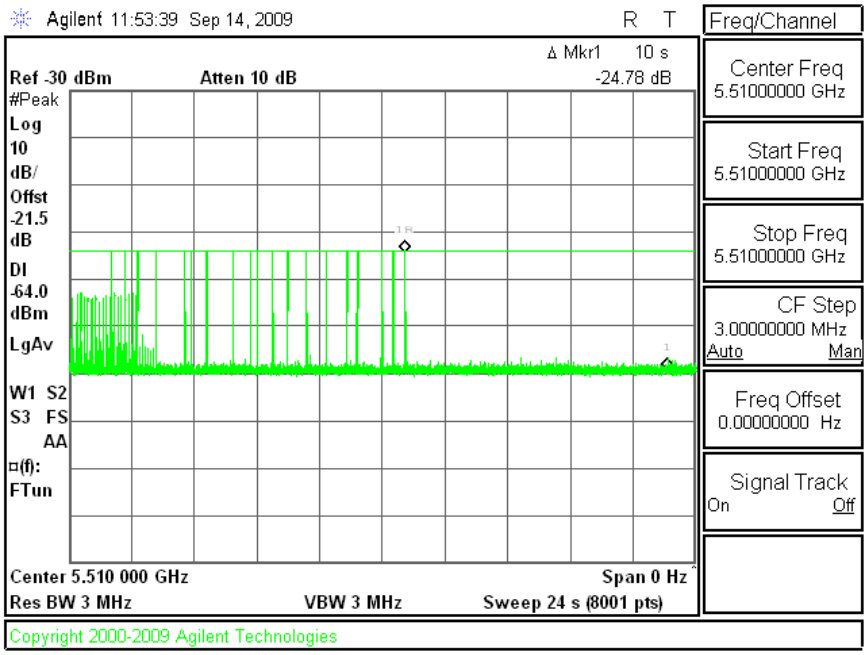
IC AGGREGATE CLOSING TIME PLOT



**LONG PULSE CHANNEL MOVE TIME**

The traffic ceases prior to 10 seconds after the end of the radar waveform.

MOVE TIME PLOT FOR LONG PULSE RADAR

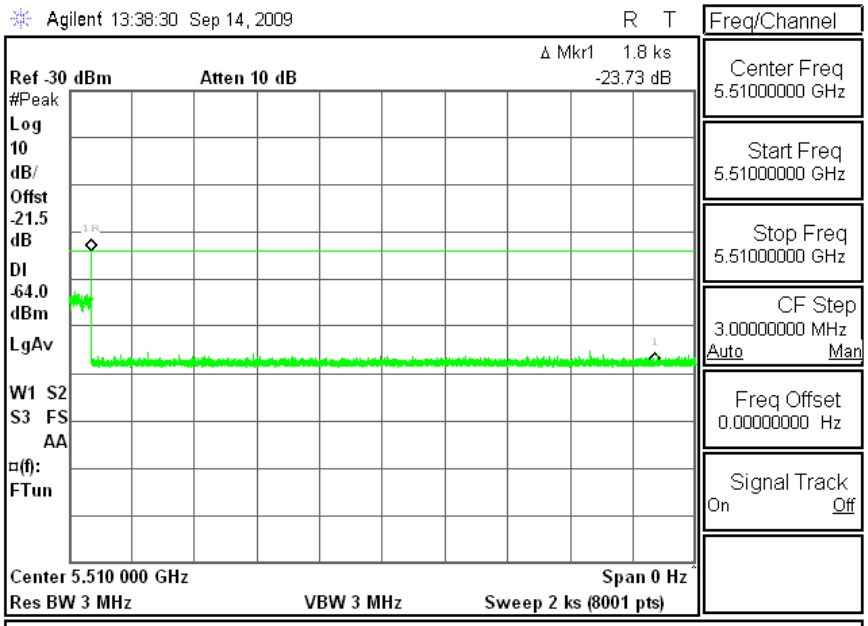


### 10.3.6. NON-OCCUPANCY PERIOD

**RESULTS**

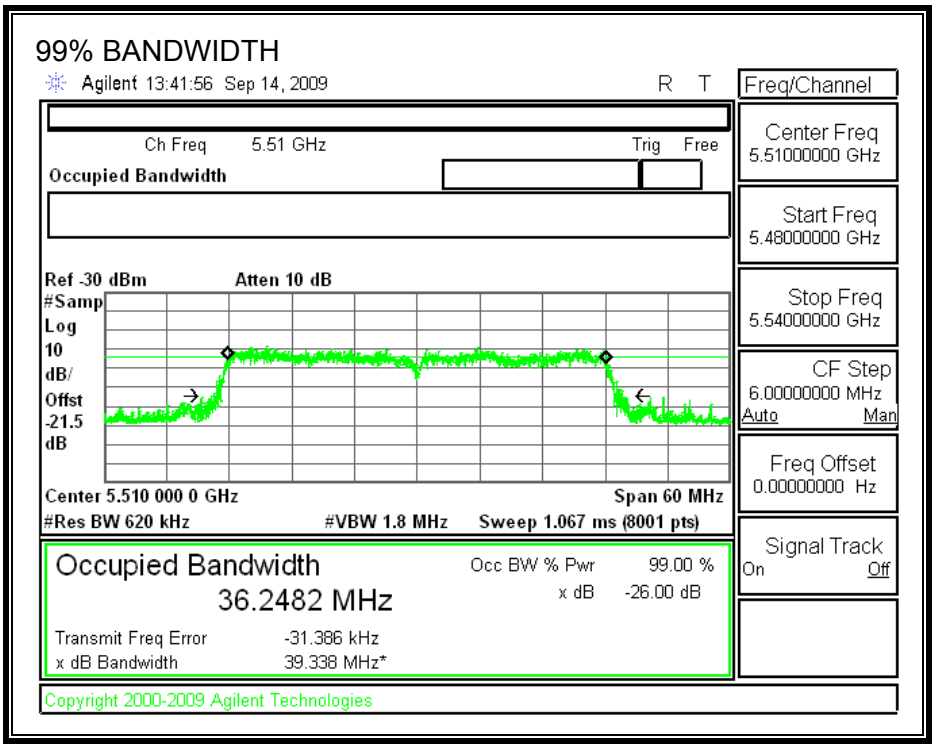
No EUT transmissions were observed on the test channel during the 30-minute observation time.

NON-OCCUPANCY PERIOD PLOT



## 10.3.7. DETECTION BANDWIDTH

**REFERENCE PLOT OF 99% POWER BANDWIDTH**




**RESULTS**

| FL (MHz) | FH (MHz) | Detection Bandwidth (MHz) | 99% Power Bandwidth (MHz) | Ratio of Detection BW to 99% Power BW (%) | Minimum Limit (%) |
|---|---|---|---|---|---|
| 5493 | 5527 | 34 | 36.248 | 93.8 | 80 |

**DETECTION BANDWIDTH PROBABILITY**

DETECTION BANDWIDTH PROBABILITY RESULTS

| Detection Bandwidth Test Results | | | | |
|---|---|---|---|---|
| FCC Type 1 Waveform: 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst | | | | |
| Frequency (MHz) | Number of Trials | Number Detected | Detection (%) | Mark |
| 5493 | 10 | 10 | 100 | FL |
| 5494 | 10 | 10 | 100 | |
| 5495 | 10 | 10 | 100 | |
| 5496 | 10 | 10 | 100 | |
| 5497 | 10 | 10 | 100 | |
| 5498 | 10 | 10 | 100 | |
| 5499 | 10 | 10 | 100 | |
| 5500 | 10 | 10 | 100 | |
| 5501 | 10 | 10 | 100 | |
| 5502 | 10 | 10 | 100 | |
| 5503 | 10 | 10 | 100 | |
| 5504 | 10 | 10 | 100 | |
| 5505 | 10 | 10 | 100 | |
| 5506 | 10 | 10 | 100 | |
| 5507 | 10 | 10 | 100 | |
| 5508 | 10 | 10 | 100 | |
| 5509 | 10 | 10 | 100 | |
| 5510 | 10 | 10 | 100 | |
| 5511 | 10 | 10 | 100 | |
| 5512 | 10 | 10 | 100 | |
| 5513 | 10 | 10 | 100 | |
| 5514 | 10 | 9 | 90 | |
| 5515 | 10 | 10 | 100 | |
| 5516 | 10 | 10 | 100 | |
| 5517 | 10 | 10 | 100 | |
| 5518 | 10 | 10 | 100 | |
| 5519 | 10 | 10 | 100 | |
| 5520 | 10 | 10 | 100 | |
| 5521 | 10 | 10 | 100 | |
| 5522 | 10 | 10 | 100 | |
| 5523 | 10 | 10 | 100 | |
| 5524 | 10 | 10 | 100 | |
| 5525 | 10 | 10 | 100 | |
| 5526 | 10 | 10 | 100 | |
| 5527 | 10 | 9 | 90 | FH |

## 10.3.8. IN-SERVICE MONITORING

**RESULTS**

| FCC Radar Test Summary | | | | |
|---|---|---|---|---|
| Signal Type | Number of Trials | Detection (%) | Limit (%) | Pass/Fail |
| FCC Short Pulse Type 1 | 30 | 90.00 | 60 | Pass |
| FCC Short Pulse Type 2 | 30 | 90.00 | 60 | Pass |
| FCC Short Pulse Type 3 | 30 | 86.67 | 60 | Pass |
| FCC Short Pulse Type 4 | 30 | 90.00 | 60 | Pass |
| Aggregate | | 89.17 | 80 | Pass |
| FCC Long Pulse Type 5 | 30 | 93.33 | 80 | Pass |
| FCC Hopping Type 6 | 35 | 97.14 | 70 | Pass |

**TYPE 1 DETECTION PROBABILITY**

| Data Sheet for FCC Short Pulse Radar Type 1<br>1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst | |
|---|---|
| Trial | Successful Detection (Yes/No) |
| 1 | Yes |
| 2 | Yes |
| 3 | Yes |
| 4 | Yes |
| 5 | Yes |
| 6 | Yes |
| 7 | Yes |
| 8 | No |
| 9 | Yes |
| 10 | Yes |
| 11 | Yes |
| 12 | Yes |
| 13 | Yes |
| 14 | Yes |
| 15 | No |
| 16 | No |
| 17 | Yes |
| 18 | Yes |
| 19 | Yes |
| 20 | Yes |
| 21 | Yes |
| 22 | Yes |
| 23 | Yes |
| 24 | Yes |
| 25 | Yes |
| 26 | Yes |
| 27 | Yes |
| 28 | Yes |
| 29 | Yes |
| 30 | Yes |

**TYPE 2 DETECTION PROBABILITY**

| Data Sheet for FCC Short Pulse Radar Type 2 | | | | |
|---|---|---|---|---|
| Waveform | Pulse Width (us) | PRI (us) | Pulses Per Burst | Successful Detection (Yes/No) |
| 2001 | 1.7 | 200.00 | 24 | Yes |
| 2002 | 2 | 198.00 | 23 | No |
| 2003 | 3.8 | 153.00 | 25 | Yes |
| 2004 | 2.5 | 210.00 | 28 | Yes |
| 2005 | 1.3 | 171.00 | 28 | Yes |
| 2006 | 2.5 | 173.00 | 27 | Yes |
| 2007 | 1.9 | 207.00 | 28 | Yes |
| 2008 | 2.4 | 195.00 | 24 | Yes |
| 2009 | 2.2 | 185.00 | 27 | Yes |
| 2010 | 1.6 | 188.00 | 27 | Yes |
| 2011 | 1.3 | 169.00 | 29 | Yes |
| 2012 | 3.2 | 199.00 | 29 | Yes |
| 2013 | 1.4 | 210.00 | 23 | Yes |
| 2014 | 1.2 | 169.00 | 27 | Yes |
| 2015 | 3.1 | 213.00 | 29 | Yes |
| 2016 | 4.5 | 213.00 | 23 | No |
| 2017 | 3.7 | 206.00 | 28 | Yes |
| 2018 | 3.1 | 212.00 | 29 | Yes |
| 2019 | 2.5 | 186.00 | 23 | Yes |
| 2020 | 2.8 | 215.00 | 28 | Yes |
| 2021 | 1 | 208.00 | 24 | Yes |
| 2022 | 4.3 | 168.00 | 27 | Yes |
| 2023 | 2.2 | 163.00 | 24 | Yes |
| 2024 | 3.7 | 216.00 | 28 | Yes |
| 2025 | 2.9 | 210.00 | 23 | Yes |
| 2026 | 4.5 | 206.00 | 26 | Yes |
| 2027 | 3.9 | 193.00 | 29 | Yes |
| 2028 | 2.4 | 230.00 | 29 | No |
| 2029 | 1 | 203.00 | 27 | Yes |
| 2030 | 3.6 | 208.00 | 27 | Yes |

**TYPE 3 DETECTION PROBABILITY**

| Data Sheet for FCC Short Pulse Radar Type 3 | | | | |
|---|---|---|---|---|
| Waveform | Pulse Width (us) | PRI (us) | Pulses Per Burst | Successful Detection (Yes/No) |
| 3001 | 5.9 | 334.00 | 18 | Yes |
| 3002 | 7.5 | 368.00 | 16 | No |
| 3003 | 5.6 | 405.00 | 18 | Yes |
| 3004 | 7 | 311.00 | 17 | Yes |
| 3005 | 6.4 | 473.00 | 17 | Yes |
| 3006 | 6.2 | 469.00 | 17 | Yes |
| 3007 | 9.1 | 355.00 | 17 | Yes |
| 3008 | 6.3 | 334.00 | 18 | Yes |
| 3009 | 9.5 | 421.00 | 17 | Yes |
| 3010 | 5.6 | 462.00 | 16 | Yes |
| 3011 | 9.8 | 252.00 | 17 | Yes |
| 3012 | 5.3 | 364.00 | 16 | Yes |
| 3013 | 7.3 | 381.00 | 17 | Yes |
| 3014 | 9.2 | 483.00 | 17 | Yes |
| 3015 | 9.2 | 310.00 | 16 | Yes |
| 3016 | 5.9 | 430.00 | 16 | Yes |
| 3017 | 7.7 | 326.00 | 17 | Yes |
| 3018 | 6.1 | 413.00 | 17 | Yes |
| 3019 | 8.1 | 453.00 | 16 | Yes |
| 3020 | 6.3 | 416.00 | 18 | No |
| 3021 | 8.3 | 271.00 | 18 | No |
| 3022 | 7.7 | 288.00 | 16 | Yes |
| 3023 | 8 | 451.00 | 17 | Yes |
| 3024 | 8.3 | 459.00 | 17 | Yes |
| 3025 | 8.5 | 310.00 | 17 | Yes |
| 3026 | 8.8 | 393.00 | 16 | Yes |
| 3027 | 9.1 | 256.00 | 17 | Yes |
| 3028 | 5.2 | 275.00 | 16 | Yes |
| 3029 | 6.3 | 374 | 18 | No |
| 3030 | 7.6 | 392 | 16 | Yes |

**TYPE 4 DETECTION PROBABILITY**

| Data Sheet for FCC Short Pulse Radar Type 4 | | | | |
|---|---|---|---|---|
| Waveform | Pulse Width (us) | PRI (us) | Pulses Per Burst | Successful Detection (Yes/No) |
| 4001 | 16.7 | 441.00 | 14 | Yes |
| 4002 | 12.2 | 305.00 | 13 | Yes |
| 4003 | 16.5 | 396.00 | 13 | Yes |
| 4004 | 13.3 | 485.00 | 12 | Yes |
| 4005 | 17.2 | 472.00 | 15 | Yes |
| 4006 | 16.9 | 308.00 | 13 | Yes |
| 4007 | 16.1 | 368.00 | 12 | Yes |
| 4008 | 18.1 | 373.00 | 13 | Yes |
| 4009 | 19.2 | 288.00 | 12 | Yes |
| 4010 | 18.8 | 353.00 | 13 | Yes |
| 4011 | 17.3 | 312.00 | 15 | No |
| 4012 | 16.3 | 481.00 | 12 | Yes |
| 4013 | 15.2 | 490.00 | 12 | Yes |
| 4014 | 17.7 | 361.00 | 14 | Yes |
| 4015 | 10.6 | 279.00 | 16 | Yes |
| 4016 | 11.1 | 346.00 | 14 | Yes |
| 4017 | 17 | 332.00 | 15 | Yes |
| 4018 | 11.6 | 300.00 | 15 | Yes |
| 4019 | 12.3 | 455.00 | 12 | Yes |
| 4020 | 19.1 | 279.00 | 15 | Yes |
| 4021 | 15.7 | 433.00 | 14 | Yes |
| 4022 | 20 | 381.00 | 15 | Yes |
| 4023 | 11.8 | 332.00 | 14 | Yes |
| 4024 | 14.6 | 265.00 | 14 | Yes |
| 4025 | 19.9 | 306.00 | 16 | No |
| 4026 | 15.3 | 327.00 | 15 | Yes |
| 4027 | 11.1 | 260.00 | 15 | Yes |
| 4028 | 13.9 | 356.00 | 13 | Yes |
| 4029 | 11.9 | 260.00 | 15 | No |
| 4030 | 17.9 | 444.00 | 12 | Yes |

**TYPE 5 DETECTION PROBABILITY**

| Data Sheet for FCC Long Pulse Radar Type 5 | |
|---|---|
| Trial | Successful Detection (Yes/No) |
| 1 | Yes |
| 2 | Yes |
| 3 | Yes |
| 4 | Yes |
| 5 | Yes |
| 6 | Yes |
| 7 | Yes |
| 8 | Yes |
| 9 | Yes |
| 10 | Yes |
| 11 | Yes |
| 12 | Yes |
| 13 | Yes |
| 14 | Yes |
| 15 | Yes |
| 16 | Yes |
| 17 | Yes |
| 18 | Yes |
| 19 | No |
| 20 | Yes |
| 21 | Yes |
| 22 | Yes |
| 23 | Yes |
| 24 | Yes |
| 25 | Yes |
| 26 | Yes |
| 27 | No |
| 28 | Yes |
| 29 | Yes |
| 30 | Yes |

Note: The Type 5 randomized parameters are shown in a separate document.

**TYPE 6 DETECTION PROBABILITY**

| Data Sheet for FCC Hopping Radar Type 6 | | | | |
|---|---|---|---|---|
| 1 us Pulse Width, 333 us PRI, 9 Pulses per Burst, 1 Burst per Hop | | | | |
| NTIA August 2005 Hopping Sequence | | | | |
| Trial | Starting Index Within Sequence | Signal Generator Frequency (MHz) | Hops within Detection BW | Successful Detection (Yes/No) |
| 1 | 166 | 5493 | 4 | Yes |
| 2 | 641 | 5494 | 12 | Yes |
| 3 | 1116 | 5495 | 8 | Yes |
| 4 | 1591 | 5496 | 4 | Yes |
| 5 | 2066 | 5497 | 6 | Yes |
| 6 | 2541 | 5498 | 6 | Yes |
| 7 | 3016 | 5499 | 6 | Yes |
| 8 | 3491 | 5500 | 8 | Yes |
| 9 | 3966 | 5501 | 5 | Yes |
| 10 | 4441 | 5502 | 9 | Yes |
| 11 | 4916 | 5503 | 8 | Yes |
| 12 | 5391 | 5504 | 9 | Yes |
| 13 | 5866 | 5505 | 7 | Yes |
| 14 | 6341 | 5506 | 5 | Yes |
| 15 | 6816 | 5507 | 8 | Yes |
| 16 | 7291 | 5508 | 11 | Yes |
| 17 | 7766 | 5509 | 10 | Yes |
| 18 | 8241 | 5510 | 7 | Yes |
| 19 | 8716 | 5511 | 7 | Yes |
| 20 | 9191 | 5512 | 8 | Yes |
| 21 | 9666 | 5513 | 8 | Yes |
| 22 | 10141 | 5514 | 4 | Yes |
| 23 | 10616 | 5515 | 3 | Yes |
| 24 | 11091 | 5516 | 7 | Yes |
| 25 | 11566 | 5517 | 6 | Yes |
| 26 | 12041 | 5518 | 5 | Yes |
| 27 | 12516 | 5519 | 8 | No |
| 28 | 12991 | 5520 | 10 | Yes |
| 29 | 13466 | 5521 | 6 | Yes |
| 30 | 13941 | 5522 | 3 | Yes |
| 31 | 14416 | 5523 | 9 | Yes |
| 32 | 14891 | 5524 | 9 | Yes |
| 33 | 15366 | 5525 | 9 | Yes |
| 34 | 15841 | 5526 | 5 | Yes |
| 35 | 16316 | 5527 | 5 | Yes |

# 11. MAXIMUM PERMISSIBLE EXPOSURE

**FCC RULES**

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

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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

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

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

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

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

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

**IC RULES**

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

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

| 1 Frequency (MHz) | 2 Electric Field Strength; rms (V/m) | 3 Magnetic Field Strength; rms (A/m) | 4 Power Density ($W/m^2$) | 5 Averaging Time (min) |
|---|---|---|---|---|
| 0.003–1 | 280 | 2.19 | | 6 |
| 1–10 | $280/f$ | $2.19/f$ | | 6 |
| 10–30 | 28 | $2.19/f$ | | 6 |
| 30–300 | 28 | 0.073 | 2* | 6 |
| 300–1 500 | $1.585f^{0.5}$ | $0.0042f^{0.5}$ | $f/150$ | 6 |
| 1 500–15 000 | 61.4 | 0.163 | 10 | 6 |
| 15 000–150 000 | 61.4 | 0.163 | 10 | $616\,000/f^{1.2}$ |
| 150 000–300 000 | $0.158f^{0.5}$ | $4.21 \times 10^{-4}f^{0.5}$ | $6.67 \times 10^{-5}f$ | $616\,000/f^{1.2}$ |

* Power density limit is applicable at frequencies greater than 100 MHz.

**Notes:** 1. Frequency, $f$, is in MHz.
2. A power density of 10 $W/m^2$ is equivalent to 1 $mW/cm^2$.
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

**EQUATIONS**

Power density is given by:

S = EIRP / (4 * Pi * D^2)

where

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

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

Distance is given by:

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

where

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

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

**LIMITS**

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2
From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m^2

**RESULTS**

(MPE distance equals 20 cm)

| Band | Mode | Separation Distance (m) | Output Power (dBm) | Antenna Gain (dBi) | IC Power Density (W/m^2) | FCC Power Density (mW/cm^2) |
|---|---|---|---|---|---|---|
| 5.2 GHz | 11a (2 Chains) | 0.20 | 12.18 | 6.01 | 0.13 | 0.013 |
| 5.2 GHz | 11n HT20 (4 Chains) | 0.20 | 13.23 | 3.0 | 0.08 | 0.008 |
| 5.2 GHz | 11n HT40 (4 Chains) | 0.20 | 16.67 | 3.0 | 0.18 | 0.018 |
| 5.3 GHz | 11a (2 Chains) | 0.20 | 19.15 | 6.01 | 0.65 | 0.065 |
| 5.3 GHz | 11n HT20 (4 Chains) | 0.20 | 20.65 | 3.0 | 0.46 | 0.046 |
| 5.3 GHz | 11n HT40 (4 Chains) | 0.20 | 23.24 | 3.0 | 0.84 | 0.084 |
| 5.6 GHz | 11a (2 Chains) | 0.20 | 19.88 | 6.01 | 0.77 | 0.077 |
| 5.6 GHz | 11n HT20 (4 Chains) | 0.20 | 20.24 | 3.0 | 0.42 | 0.042 |
| 5.6 GHz | 11n HT40 (4 Chains) | 0.20 | 23.80 | 3.0 | 0.95 | 0.095 |