



FCC CFR47 PART 15 SUBPART E

**CERTIFICATION TEST REPORT
CLASS II PERMISSIVE CHANGE**

FOR

**APPLE TV DEVICE (DIGITAL MEDIA RECEIVER) WITH WIFI AND BLUETOOTH
RADIOS**

MODEL NUMBER: A1469

FCC ID: BCGA1469

REPORT NUMBER: 15U21850-E36V1

ISSUE DATE: NOVEMBER 30, 2015

Prepared for
APPLE, INC.
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A

Prepared by
UL VERIFICATION SERVICES INC.
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 |
|------|------------|---|------------|
| V1 | 11/30/15 | Initial issue. Upgrade 12U14680-3, Revision C report to 5.2/5.3/5.6GHz band to new rule per KDB 789033 D02 v01. | J. Vang |

TABLE OF CONTENTS

| | |
|--|-----------|
| 1. ATTESTATION OF TEST RESULTS | 6 |
| 2. TEST METHODOLOGY | 7 |
| 3. FACILITIES AND ACCREDITATION | 7 |
| 4. CALIBRATION AND UNCERTAINTY | 7 |
| 4.1. MEASURING INSTRUMENT CALIBRATION | 7 |
| 4.2. SAMPLE CALCULATION | 7 |
| 4.3. MEASUREMENT UNCERTAINTY | 7 |
| 5. EQUIPMENT UNDER TEST | 8 |
| 5.1. DESCRIPTION OF EUT | 8 |
| 5.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE | 8 |
| 5.3. MAXIMUM OUTPUT POWER..... | 8 |
| 5.4. DESCRIPTION OF AVAILABLE ANTENNAS | 9 |
| 5.5. SOFTWARE AND FIRMWARE..... | 9 |
| 5.6. WORST-CASE CONFIGURATION AND MODE..... | 9 |
| 5.7. DESCRIPTION OF TEST SETUP..... | 10 |
| 6. TEST AND MEASUREMENT EQUIPMENT | 12 |
| 7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS | 13 |
| 7.1.1. ON TIME AND DUTY CYCLE RESULTS..... | 13 |
| 7.1.2. MEASUREMENT METHOD FOR POWER AND PPSD | 13 |
| 7.1.3. MEASUREMENT METHOD FOR AVG SPURIOUS EMISSIONS ABOVE 1 GHz | 13 |
| 7.1.4. DUTY CYCLE PLOTS | 14 |
| 8. ANTENNA PORT TEST RESULTS | 16 |
| 8.1. 802.11a MODE IN THE 5.2 GHz BAND..... | 16 |
| 8.1.1. 26 dB BANDWIDTH..... | 16 |
| 8.1.2. 99% BANDWIDTH..... | 19 |
| 8.1.3. AVERAGE POWER..... | 22 |
| 8.1.4. OUTPUT POWER AND PPSD | 23 |
| 8.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND | 27 |
| 8.2.1. 26 dB BANDWIDTH..... | 27 |
| 8.2.2. 99% BANDWIDTH..... | 30 |
| 8.2.3. AVERAGE POWER | 33 |
| 8.2.4. OUTPUT POWER AND PPSD | 34 |
| 8.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND | 38 |
| 8.3.1. 26 dB BANDWIDTH..... | 38 |
| 8.3.2. 99% BANDWIDTH..... | 40 |
| 8.3.3. AVERAGE POWER | 42 |
| 8.3.4. OUTPUT POWER AND PPSD | 43 |

| | | |
|--------|---|------------|
| 8.4. | 802.11a MODE IN THE 5.3 GHz BAND..... | 46 |
| 8.4.1. | 26 dB BANDWIDTH..... | 46 |
| 8.4.2. | 99% BANDWIDTH..... | 49 |
| 8.4.3. | AVERAGE POWER..... | 52 |
| 8.4.4. | OUTPUT POWER AND PPSD | 53 |
| 8.4.5. | TPC POWER..... | 57 |
| 8.5. | 802.11n HT20 MODE IN THE 5.3 GHz BAND | 58 |
| 8.5.1. | 26 dB BANDWIDTH..... | 58 |
| 8.5.2. | 99% BANDWIDTH..... | 61 |
| 8.5.3. | AVERAGE POWER..... | 64 |
| 8.5.4. | OUTPUT POWER AND PPSD | 65 |
| 8.5.5. | TPC POWER..... | 69 |
| 8.6. | 802.11n HT40 MODE IN THE 5.3 GHz BAND | 70 |
| 8.6.1. | 26 dB BANDWIDTH..... | 70 |
| 8.6.2. | 99% BANDWIDTH..... | 72 |
| 8.6.3. | AVERAGE POWER..... | 74 |
| 8.6.4. | OUTPUT POWER AND PPSD | 75 |
| 8.6.5. | TPC POWER..... | 78 |
| 8.7. | 802.11a MODE IN THE 5.6 GHz BAND..... | 79 |
| 8.7.1. | 26 dB BANDWIDTH..... | 79 |
| 8.7.2. | 99% BANDWIDTH..... | 83 |
| 8.7.3. | AVERAGE POWER..... | 87 |
| 8.7.4. | OUTPUT POWER AND PPSD | 88 |
| 8.7.5. | TPC POWER..... | 93 |
| 8.8. | 802.11n HT20 MODE IN THE 5.6 GHz BAND | 94 |
| 8.8.1. | 26 dB BANDWIDTH..... | 94 |
| 8.8.2. | 99% BANDWIDTH..... | 98 |
| 8.8.3. | AVERAGE POWER..... | 102 |
| 8.8.4. | OUTPUT POWER AND PPSD | 103 |
| 8.8.5. | TPC POWER..... | 108 |
| 8.9. | 802.11n HT40 MODE IN THE 5.6 GHz BAND | 109 |
| 8.9.1. | 26 dB BANDWIDTH..... | 109 |
| 8.9.2. | 99% BANDWIDTH..... | 112 |
| 8.9.3. | AVERAGE POWER..... | 115 |
| 8.9.4. | OUTPUT POWER AND PPSD | 116 |
| 8.9.5. | TPC POWER..... | 120 |
| 9. | RADIATED TEST RESULTS..... | 121 |
| 9.1. | LIMITS AND PROCEDURE..... | 121 |
| 9.2. | TX ABOVE 1 GHz 802.11a MODE IN THE 5.2 GHz BAND | 122 |
| 9.3. | TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.2 GHz BAND..... | 125 |
| 9.4. | TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.2 GHz BAND..... | 128 |
| 9.5. | TX ABOVE 1 GHz 802.11a MODE IN THE 5.3 GHz BAND | 133 |
| 9.6. | TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.3 GHz BAND..... | 138 |
| 9.7. | TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.3 GHz BAND..... | 143 |
| 9.8. | TX ABOVE 1 GHz 802.11a MODE IN THE 5.6 GHz BAND | 148 |

| | | |
|------------|---|------------|
| 9.9. | TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.6 GHz BAND..... | 155 |
| 9.10. | TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.6 GHz BAND | 162 |
| 9.11. | WORST-CASE BELOW 1 GHz | 168 |
| 10. | AC POWER LINE CONDUCTED EMISSIONS | 171 |
| 11. | DYNAMIC FREQUENCY SELECTION | 175 |
| 11.1. | OVERVIEW..... | 175 |
| 11.1.1. | LIMITS | 175 |
| 11.1.2. | TEST AND MEASUREMENT SYSTEM | 178 |
| 11.1.3. | SETUP OF EUT (CLIENT MODE)..... | 181 |
| 11.1.4. | SETUP OF EUT (CLIENT-TO-CLIENT COMMUNICATIONS MODE) | 182 |
| 11.1.5. | DESCRIPTION OF EUT | 183 |
| 11.2. | CLIENT MODE RESULTS FOR 20 MHz BANDWIDTH..... | 185 |
| 11.2.1. | TEST CHANNEL | 185 |
| 11.2.2. | RADAR WAVEFORM AND TRAFFIC | 185 |
| 11.2.3. | OVERLAPPING CHANNEL TESTS | 187 |
| 11.2.4. | MOVE AND CLOSING TIME | 187 |
| 11.3. | CLIENT MODE RESULTS FOR 40 MHz BANDWIDTH..... | 192 |
| 11.3.1. | TEST CHANNEL | 192 |
| 11.3.2. | RADAR WAVEFORM AND TRAFFIC | 192 |
| 11.3.3. | OVERLAPPING CHANNEL TESTS | 194 |
| 11.3.4. | MOVE AND CLOSING TIME | 194 |
| 11.3.5. | NON-OCCUPANCY PERIOD | 199 |
| 11.4. | CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 20 MHz BANDWIDTH..... | 200 |
| 11.4.1. | TEST CHANNEL | 200 |
| 11.4.2. | RADAR WAVEFORM AND TRAFFIC | 200 |
| 11.4.3. | OVERLAPPING CHANNEL TESTS | 202 |
| 11.4.4. | MOVE AND CLOSING TIME | 202 |
| 11.5. | CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 40 MHz BANDWIDTH..... | 207 |
| 11.5.1. | TEST CHANNEL | 207 |
| 11.5.2. | RADAR WAVEFORM AND TRAFFIC | 207 |
| 11.5.3. | OVERLAPPING CHANNEL TESTS | 209 |
| 11.5.4. | MOVE AND CLOSING TIME | 209 |
| 13. | SETUP PHOTOS | 214 |
| 13.1. | ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP | 214 |
| 13.2. | RADIATED RF MEASUREMENT SETUP FOR PORTABLE CONFIGURATION .. | 215 |
| 13.3. | POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP | 217 |
| 13.4. | DYNAMIC FREQUENCY SELECTION MEASUREMENT SETUP | 218 |

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE, INC.
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

EUT DESCRIPTION: APPLE TV DEVICE (DIGITAL MEDIA RECEIVER) WITH WIFI
AND BLUETOOTH RADIOS

MODEL: A1469

SERIAL NUMBER: PT779512 (RF); C07J700LF7G4 (DFS)

DATE TESTED: OCTOBER 22 – NOVEMBER 09, 2012

| APPLICABLE STANDARDS | |
|--------------------------|--------------|
| STANDARD | TEST RESULTS |
| CFR 47 Part 15 Subpart E | Pass |

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

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

Approved & Released For
UL Verification Services Inc. By:



FRANK IBRAHIM
WiSE PROJECT LEADER
UL Verification Services Inc.

Tested By:



TOM CHEN
EMC ENGINEER
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 14-30, FCC KDB 662911 D01 v02r01, FCC KDB 905462 D02 v01r02/D03 v01r01/D06 v01, FCC KDB 789033 D02 v01, ANSI C63.10-2009.

3. FACILITIES AND ACCREDITATION

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

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.htm>.

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:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

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 Apple TV device is a digital media receiver designed to play internet content onto a TV through an HDMI port. It incorporates WiFi and Bluetooth radios.

The radio module is manufactured by Broadcom.

5.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

Upgrade 5.2/5.3/5.6GHz band to new rule per KDB 789033 D02 v01.

We have reviewed the original test report for UNII-1, UNII-2A and UNII-2C bands and are hereby attesting that all current technical requirements are still met and all applicable test procedures remain the same. Therefore, the original report is still applicable and no additional testing is done.

We updated the following on this report:

- Updated report to latest KDB 789033 D02 v01.
- 5.2G output power table limit/PPSD limit.
- Removed IC related information.
- Removed Peak Excursion.

5.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

| Frequency Range (MHz) | Mode of operation | Modulation | Output Power (dBm) | Output Power (mW) |
|--------------------------|-------------------------|------------|-----------------------|----------------------|
| 5180 - 5240 | 802.11a | OFDM | 14.15 | 26.00 |
| 5180 - 5240 | 802.11n HT20 | OFDM | 14.05 | 25.41 |
| 5190 - 5230 | 802.11n HT40 | OFDM | 15.59 | 36.22 |
| 5260 - 5320 | 802.11a | OFDM | 19.71 | 93.54 |
| 5260 - 5320 | 802.11n HT20 | OFDM | 19.69 | 93.11 |
| 5270 - 5310 | 802.11n HT40 | OFDM | 16.3 | 42.66 |
| 5500 - 5700 | 802.11a | OFDM | 19.83 | 96.16 |
| 5500 - 5700 | 802.11n HT20 | OFDM | 20.44 | 110.66 |
| 5510 - 5670 | 802.11n HT40 | OFDM | 16.37 | 43.35 |

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain as below.

| Antenna Gain: | |
|-----------------|------------|
| Frequency (MHz) | Gain (dBi) |
| 2412 | 3.4 |
| 5180 | 3.93 |
| 5260 | 3.16 |
| 5540 | 2.34 |
| 5745 | 2.62 |

5.5. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was Rel_6_10_56_189.

The test utility software used during testing was Broadcom WL tool Ver. 6.10 RC56.189.

5.6. WORST-CASE CONFIGURATION AND MODE

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, and it was found that X orientation is worst-case orientation; therefore, final radiated testing was performed with the EUT in the X orientation.

For Radiated Emissions below 1 GHz and Power line Conducted Emissions, the channel with the highest conducted output power was selected as a worst-case scenario.

The worst-case data rate for each mode, used for testing, was as follows, based on an input from the manufacturer of the radio.

All final tests in the 802.11n HT20 mode were made at MCS0

All final tests in the 802.11n HT40 mode were made at MCS0

All final tests in the 802.11a mode were made at 6 Mb/s

Whenever the second low channel in band has a higher target power than the first low channel, all testing for the first low channel (except output power, 26 dB BW, 99% BW, Radiated BE) has been done at the higher power value of the second low channel as worst-case scenario.

Whenever the second high channel in band has a higher target power than the first high channel, all testing for the first high channel (except output power, 26 dB BW, 99% BW, Radiated BE) has been done at the higher power value of the second high channel as worst-case scenario.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

| Support Equipment List | | | | |
|------------------------|--------------|--------------|--------------------|--------|
| Description | Manufacturer | Model | Serial Number | FCC ID |
| Laptop PC | Apple | MacBook M42A | PT358811 | DoC |
| AC-DC Adapter | Apple | A1343 | N/A | N/A |
| Debug Board | Apple | J33 | C0314030137DPK73T | N/A |
| Mouse | HP | MOAFUO | CT: FATSK0J9W0EFU4 | DoC |

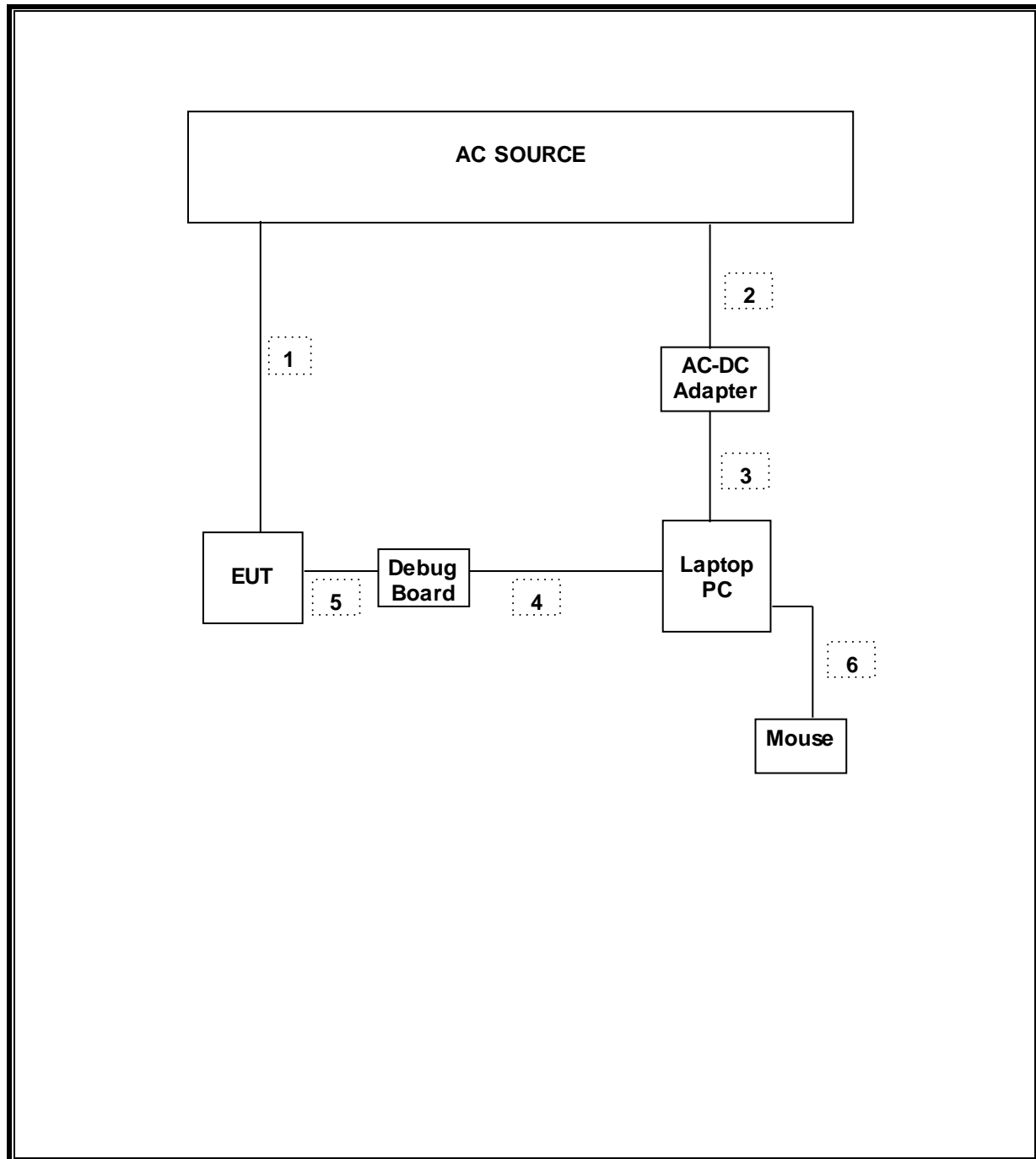
I/O CABLES

| I/O Cable List | | | | | | |
|----------------|--------|----------------------|----------------|--------------|------------------|---------|
| Cable No | Port | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1 | AC | 1 | 2P | Non-shielded | 1.83 | |
| 2 | AC | 1 | 3P | Non-shielded | 1.85 | |
| 3 | DC | 1 | DC | Non-shielded | 1.8 | |
| 4 | USB | 1 | USB | Non-shielded | 1.87 | |
| 5 | Signal | 1 | Parallel | Non-shielded | 0.09 | |
| 6 | USB | 1 | USB | Non-shielded | 1.9 | |

TEST SETUP

The EUT is powered by AC source only during test. Test software exercised the radio card.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

| Test Equipment List | | | | |
|-------------------------------------|----------------|------------------|----------|----------|
| Description | Manufacturer | Model | Asset | Cal Due |
| Preamplifier, 26.5 GHz | Agilent / HP | 8449B | C01052 | 12/11/12 |
| Antenna, Horn, 18 GHz | EMCO | 3115 | C00783 | 10/25/13 |
| Preamplifier, 1300 MHz | Agilent / HP | 8447D | C00580 | 11/11/12 |
| Antenna, Bilog, 2 GHz | Sunol Sciences | JB1 | | 02/07/13 |
| Horn Antenna, 26.5 GHz | ARA | MWH-1826/B | C00589 | 04/23/13 |
| Horn Antenna, 40 GHz | ARA | MWH-2640/B | C00981 | 06/14/13 |
| Preamplifier, 40 GHz | Miteq | NSP4000-SP2 | C00990 | 03/14/13 |
| Spectrum Analyzer, 44 GHz | Agilent / HP | E4446A | C01069 | 12/15/12 |
| E-Series Power Sensor 9 kHz~18 GHz | Agilent | E9304A | 1260847C | 05/23/13 |
| P-Series single channel Power Meter | Agilent / HP | N1911A | | 07/27/13 |
| Reject Filter, 5.725-5.825 GHz | Micro-Tronics | BRC13192 | N02676 | CNR |
| Reject Filter, 2.4-2.5 GHz | Micro-Tronics | BRM50702 | N02685 | CNR |
| Highpass Filter, 7.6 GHz | Micro-Tronics | HPM13195 | N02682 | CNR |
| EMI Test Receiver, 30MHz | R & S | ESHS 20 | N02396 | 08/19/13 |
| LISN, 30 MHz | FCC | LISN-50/250-25-2 | N02625 | 12/13/12 |

7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 789033 Zero-Span Spectrum Analyzer Method.

7.1.1. ON TIME AND DUTY CYCLE RESULTS

| Mode | ON Time B (msec) | Period (msec) | Duty Cycle x (linear) | Duty Cycle (%) | Duty Cycle Correction Factor (dB) | 1/B Minimum VBW (kHz) |
|----------------|------------------------|------------------|-----------------------------|----------------------|---|-----------------------------|
| 802.11a 20 MHz | 2.0600 | 2.0910 | 0.985 | 98.5% | 0.00 | 0.010 |
| 802.11n HT20 | 1.9150 | 1.9400 | 0.987 | 98.7% | 0.00 | 0.010 |
| 802.11n HT40 | 0.9400 | 0.9567 | 0.983 | 98.3% | 0.00 | 0.010 |

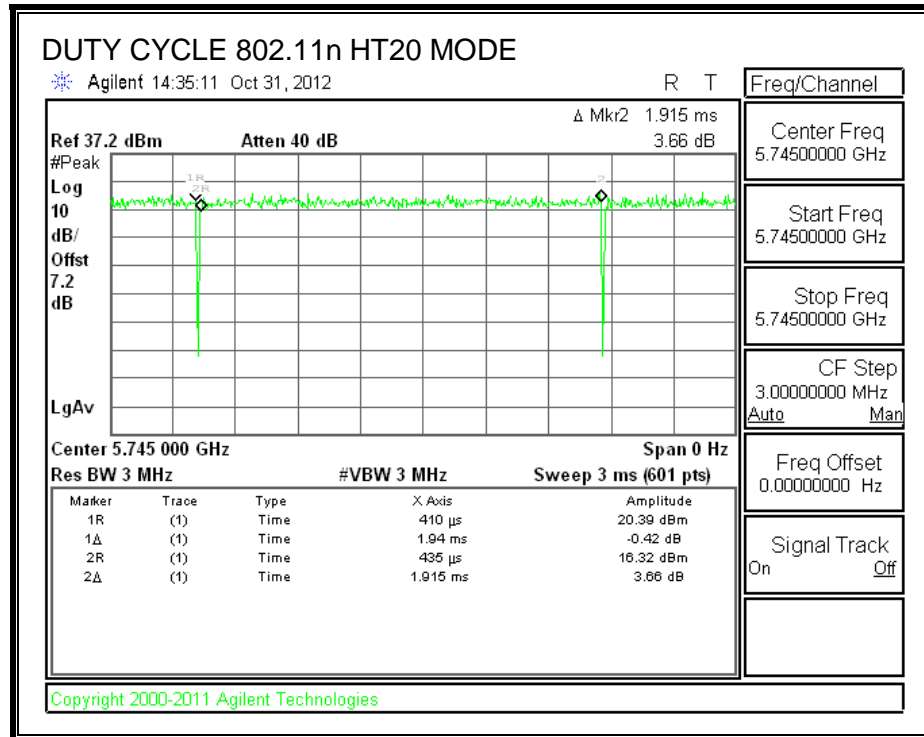
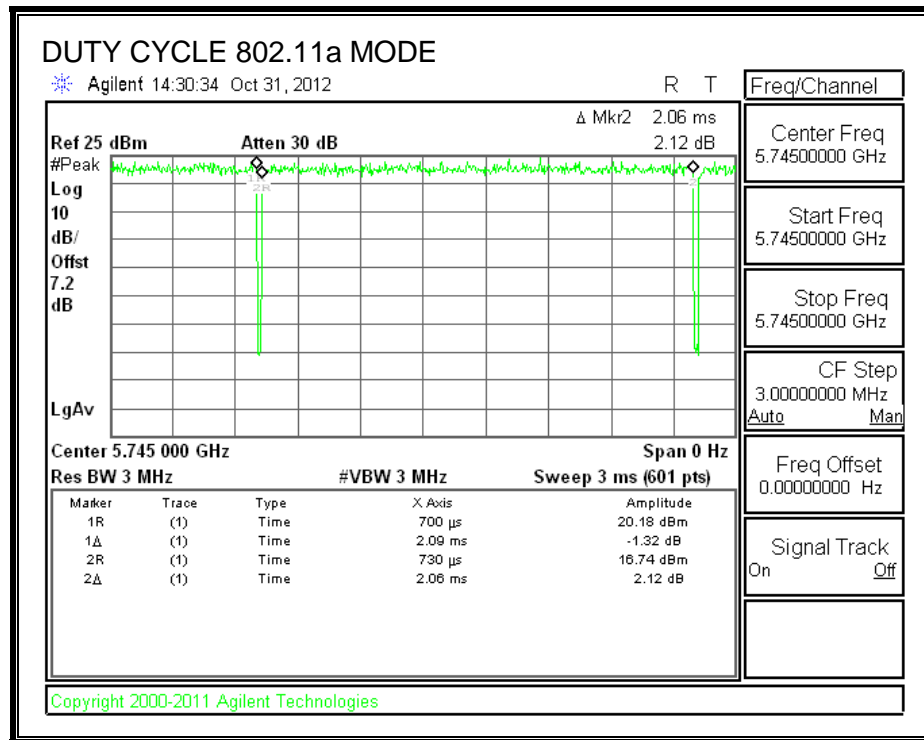
7.1.2. MEASUREMENT METHOD FOR POWER AND PPSD

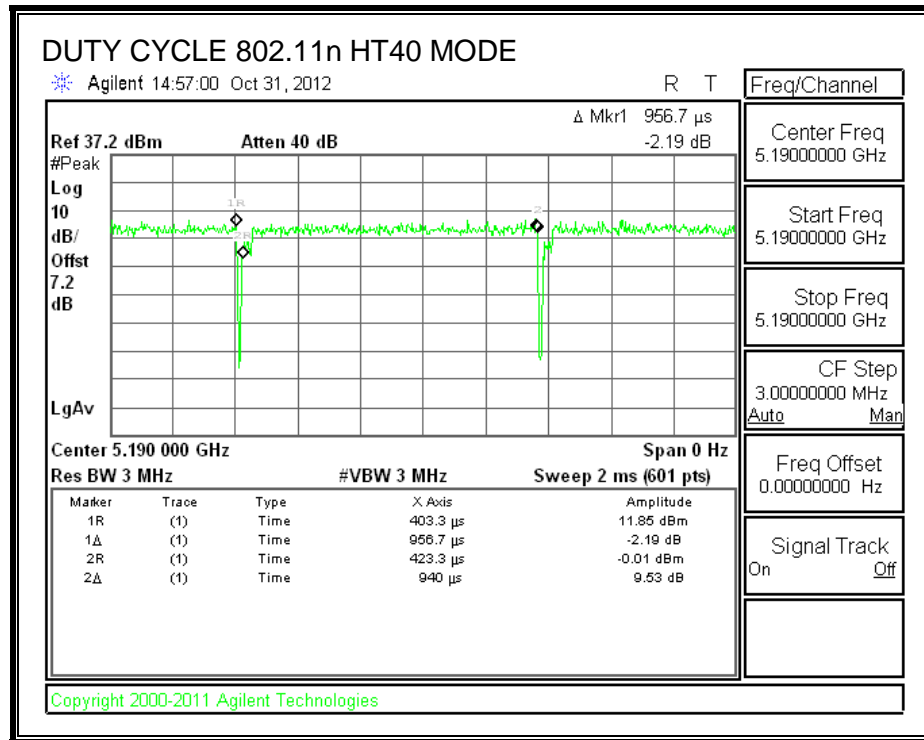
The Duty Cycle is greater than or equal to 98% therefore KDB 789033 Method SA-1 is used.

7.1.3. MEASUREMENT METHOD FOR AVG SPURIOUS EMISSIONS ABOVE 1 GHz

The Duty Cycle is greater than or equal to 98%, KDB 789033 Method VB with Power RMS Averaging is used.

7.1.4. DUTY CYCLE PLOTS





8. ANTENNA PORT TEST RESULTS

8.1. 802.11a MODE IN THE 5.2 GHz BAND

8.1.1. 26 dB BANDWIDTH

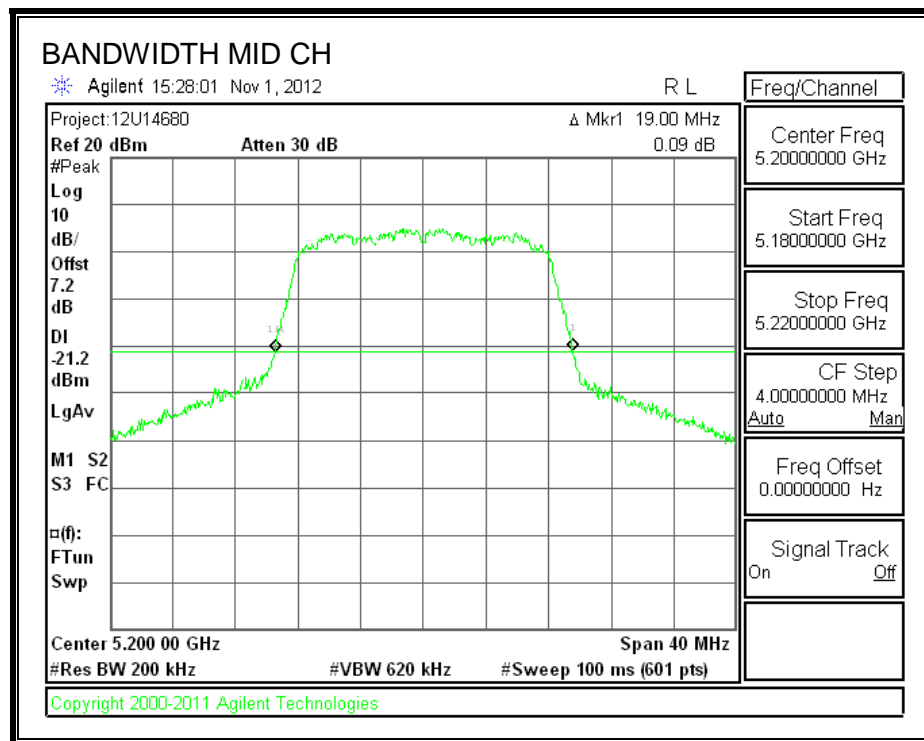
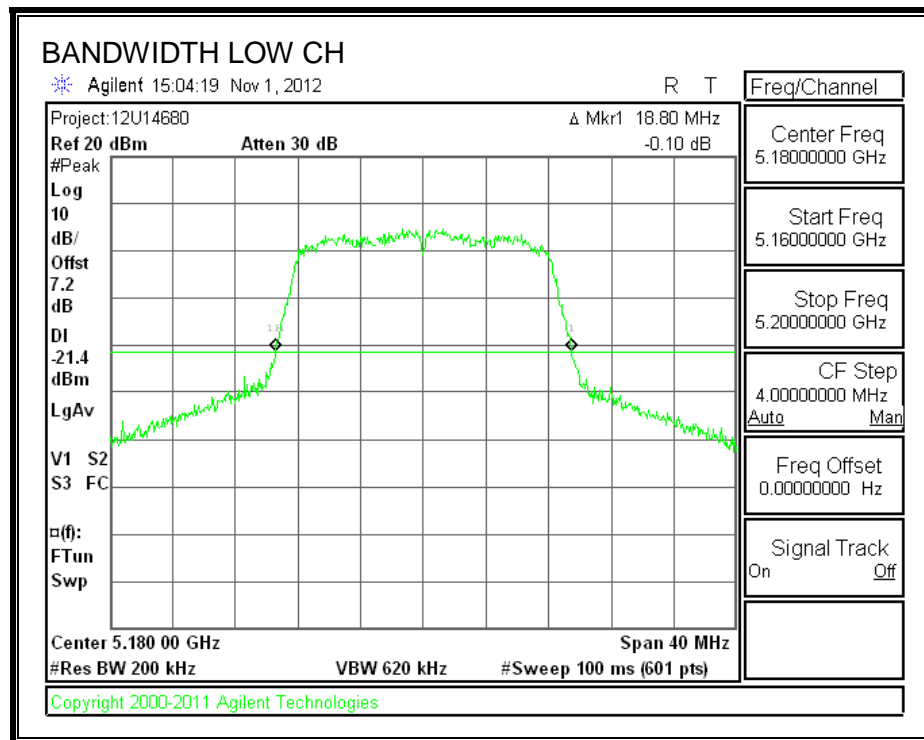
LIMITS

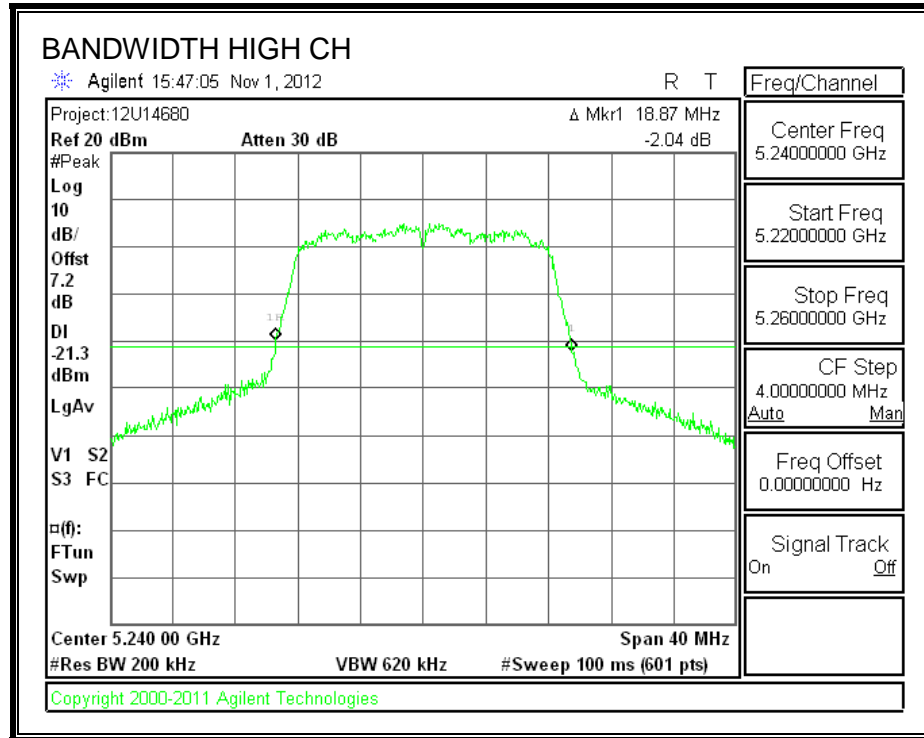
None; for reporting purposes only.

RESULTS

| Channel | Frequency (MHz) | 26 dB Bandwidth (MHz) |
|---------|--------------------|--------------------------|
| Low | 5180 | 18.80 |
| Mid | 5200 | 19.00 |
| High | 5240 | 18.87 |

26 dB BANDWIDTH





8.1.2. 99% BANDWIDTH

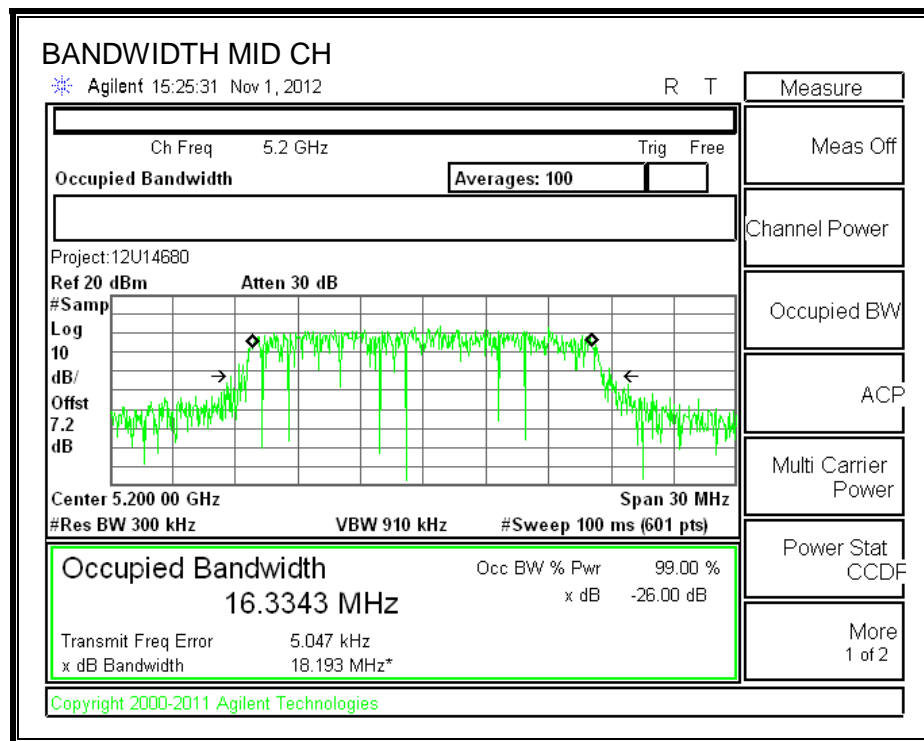
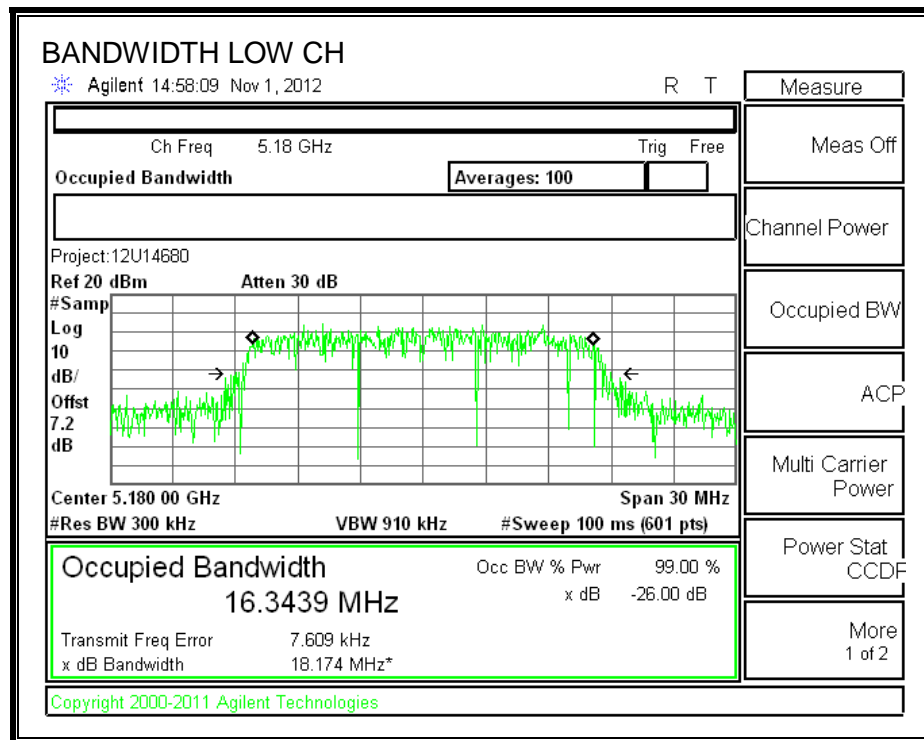
LIMITS

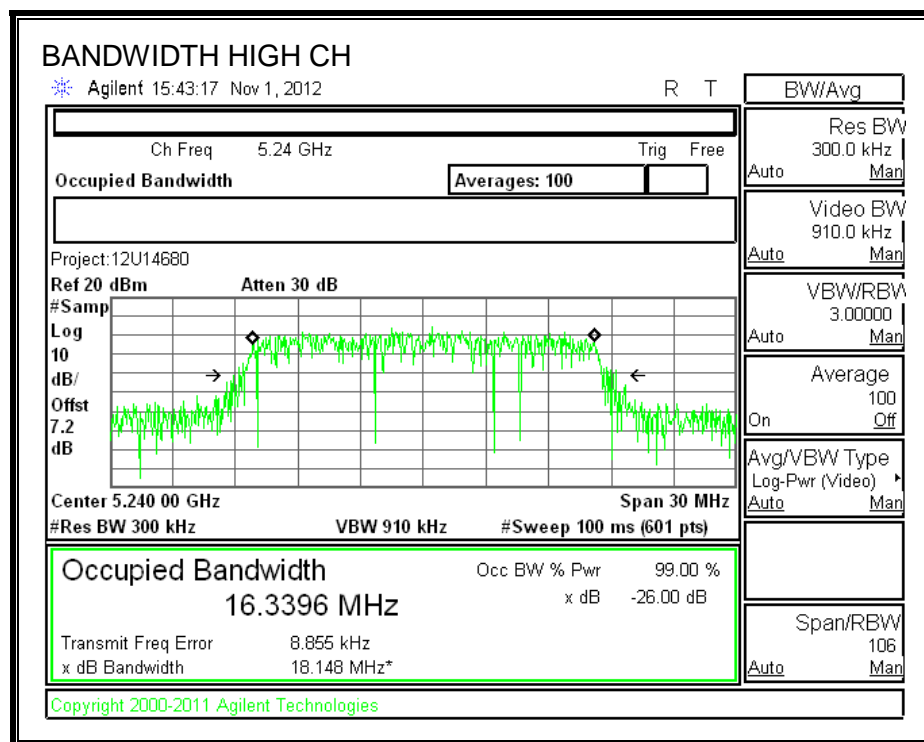
None; for reporting purposes only.

RESULTS

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|--------------------|------------------------|
| Low | 5180 | 16.3439 |
| Mid | 5200 | 16.3343 |
| High | 5240 | 16.3396 |

99% BANDWIDTH





8.1.3. 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 10.9 dB (including 10 dB pad and 0.9 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

| Channel | Frequency (MHz) | Power (dBm) |
|---------|--------------------|----------------|
| Low | 5180 | 14.0 |
| Mid | 5200 | 14.0 |
| High | 5240 | 14.0 |

8.1.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple colocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Antenna Gain

| Channel | Frequency (MHz) | Directional Gain (dBi) |
|---------|--------------------|------------------------------|
| Low | 5180 | 3.93 |
| Mid | 5200 | 3.93 |
| High | 5240 | 3.93 |

Limits

| Channel | Frequency (MHz) | FCC Power Limit (dBm) | FCC PPSD Limit (dBm) |
|---------|--------------------|--------------------------------|-------------------------------|
| Low | 5180 | 24.00 | 11.00 |
| Mid | 5200 | 24.00 | 11.00 |
| High | 5240 | 24.00 | 11.00 |

| | | |
|--------------------|------|---|
| Duty Cycle CF (dB) | 0.00 | Included in Calculations of Corr'd Power & PPSP |
|--------------------|------|---|

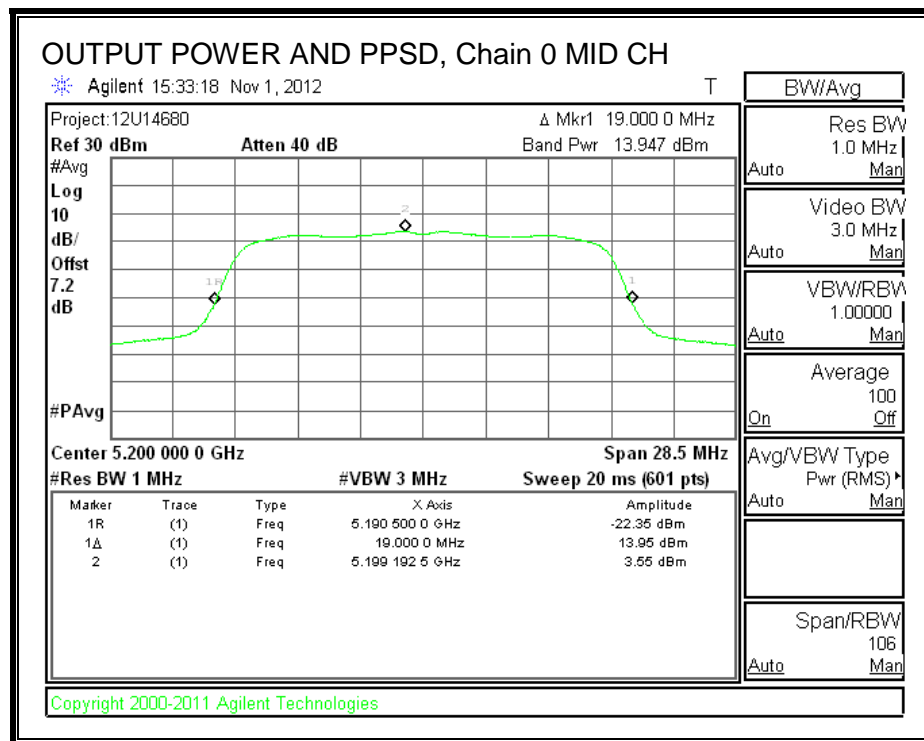
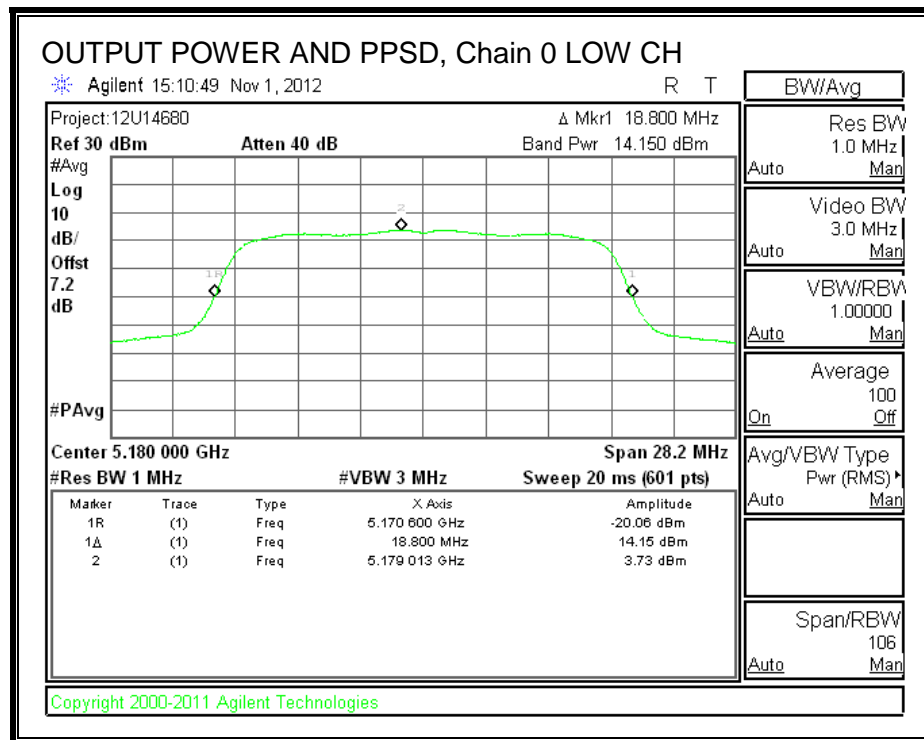
Output Power Results

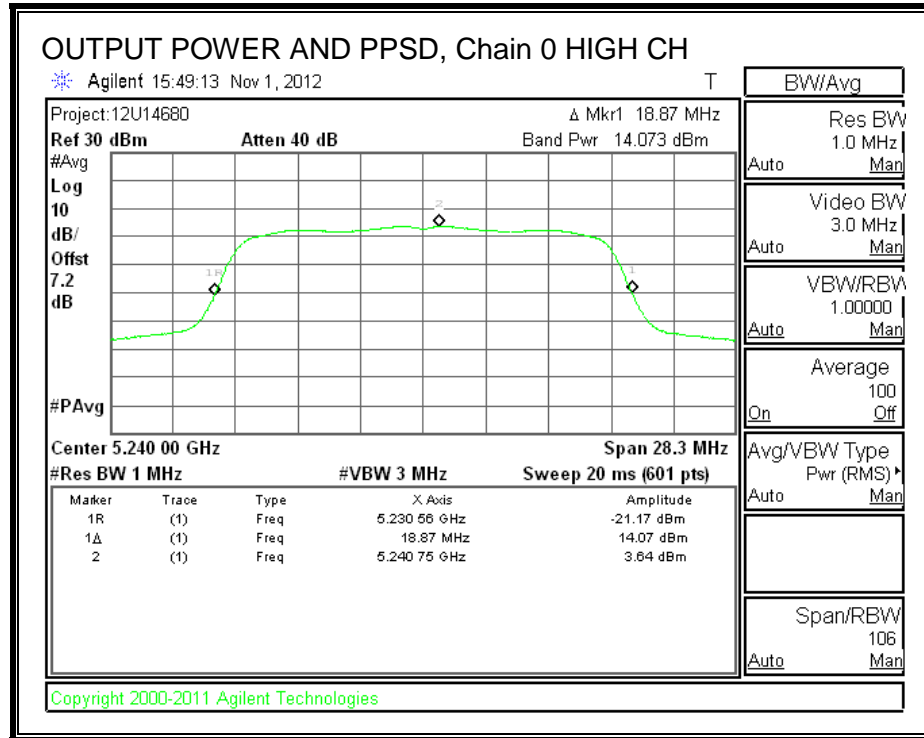
| Channel | Frequency (MHz) | Chain 0 Meas Power (dBm) | Total Corr'd Power (dBm) | Power Limit (dBm) | Power Margin (dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-------------------------|-------------------------|
| Low | 5180 | 14.15 | 14.15 | 24.00 | -9.85 |
| Mid | 5200 | 13.95 | 13.95 | 24.00 | -10.05 |
| High | 5240 | 14.07 | 14.07 | 24.00 | -9.93 |

PPSD Results

| Channel | Frequency (MHz) | Chain 0 Meas PPSD (dBm) | Total Corr'd PPSD (dBm) | PPSD Limit (dBm) | PPSD Margin (dB) |
|---------|--------------------|----------------------------------|----------------------------------|------------------------|------------------------|
| Low | 5180 | 3.73 | 3.73 | 11.00 | -7.27 |
| Mid | 5200 | 3.55 | 3.55 | 11.00 | -7.45 |
| High | 5240 | 3.64 | 3.64 | 11.00 | -7.36 |

OUTPUT POWER AND PPSD, Chain 0





8.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

8.2.1. 26 dB BANDWIDTH

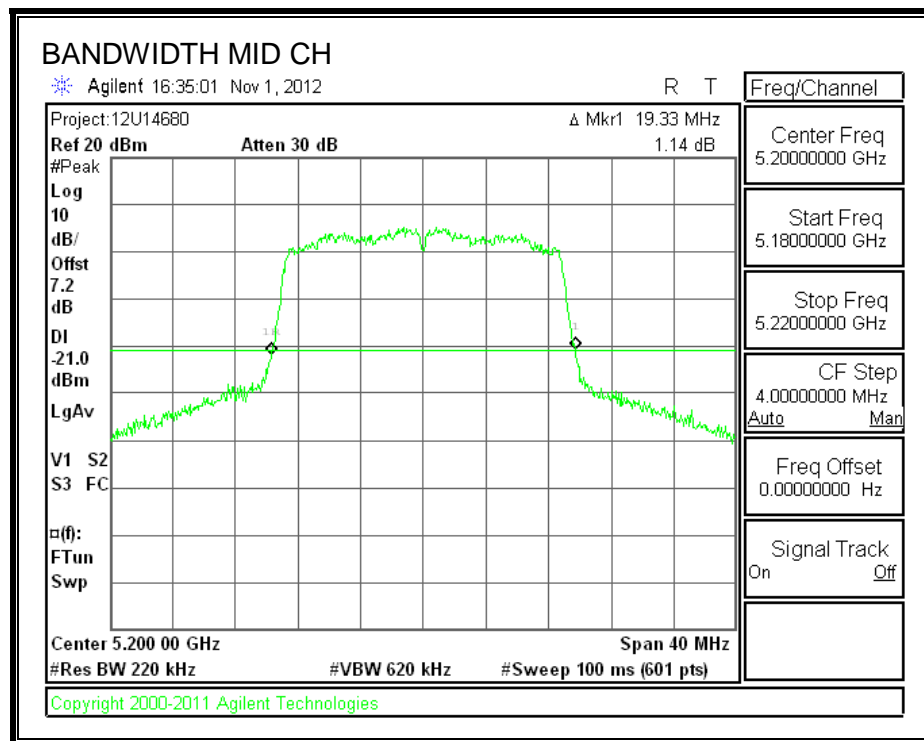
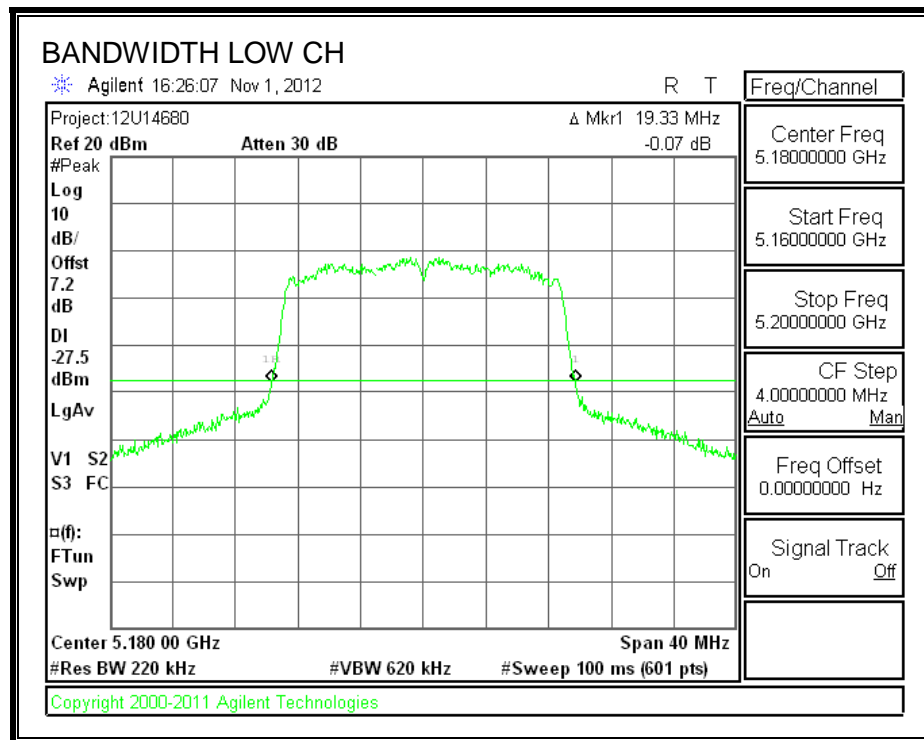
LIMITS

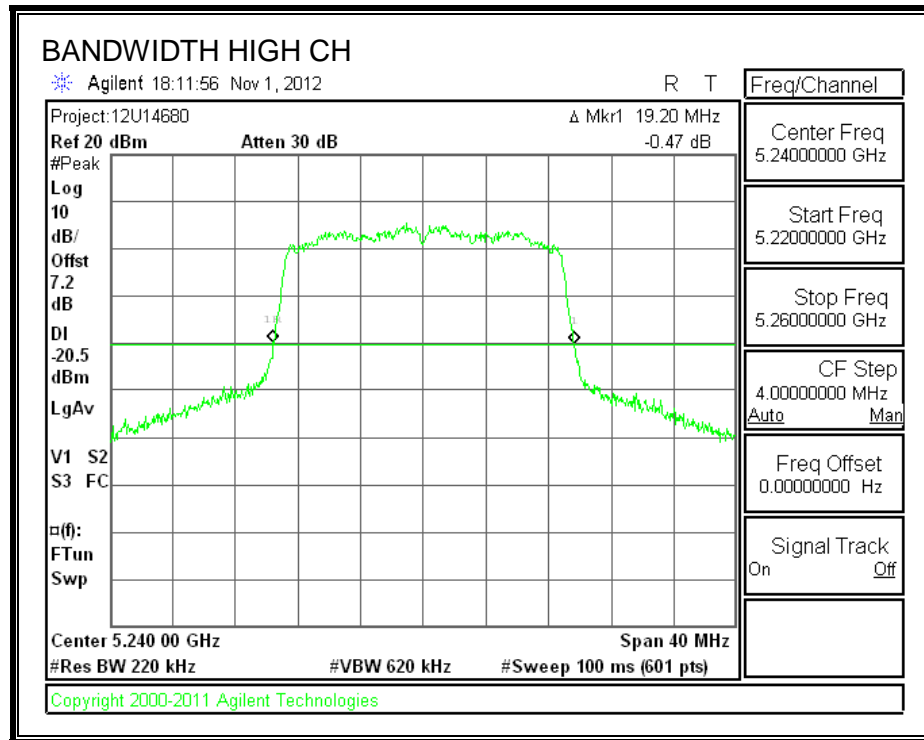
None; for reporting purposes only.

RESULTS

| Channel | Frequency (MHz) | 26 dB Bandwidth (MHz) |
|---------|--------------------|--------------------------|
| Low | 5180 | 19.33 |
| Mid | 5200 | 19.33 |
| High | 5240 | 19.20 |

26 dB BANDWIDTH





8.2.2. 99% BANDWIDTH

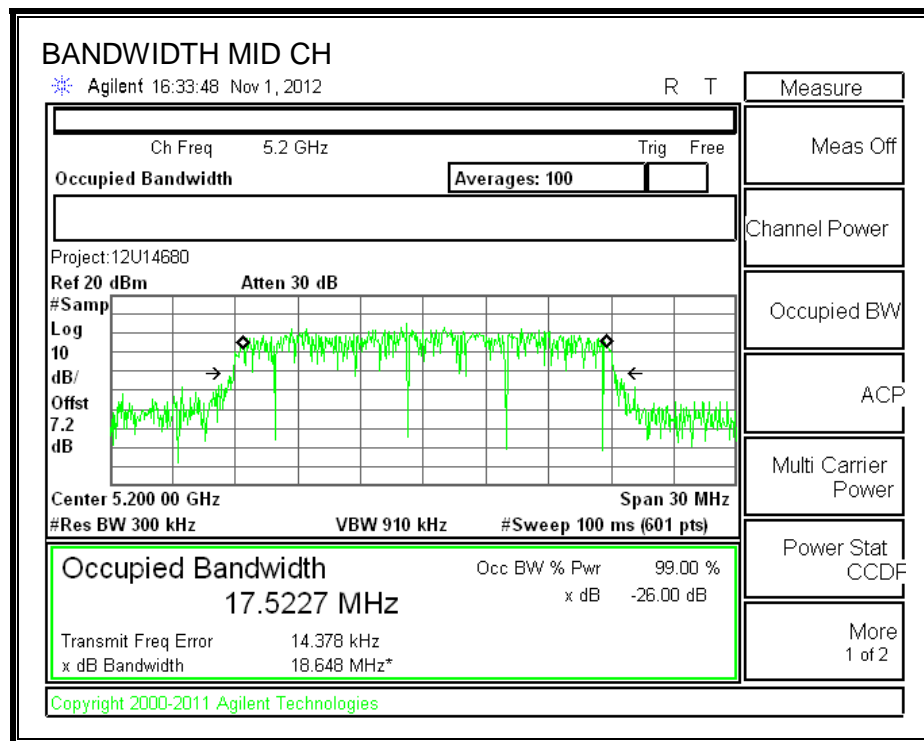
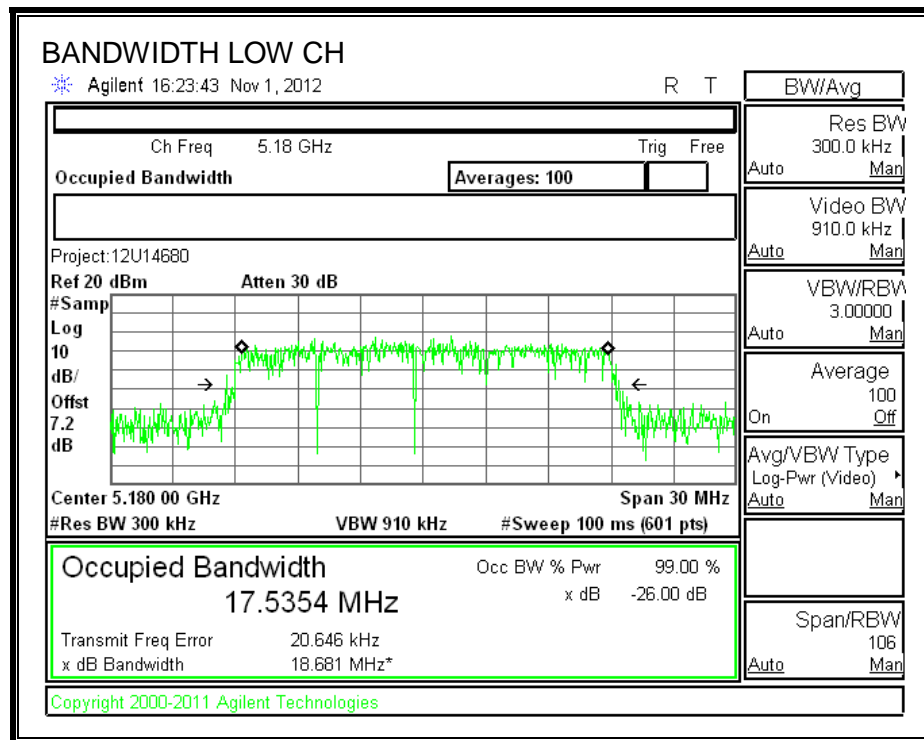
LIMITS

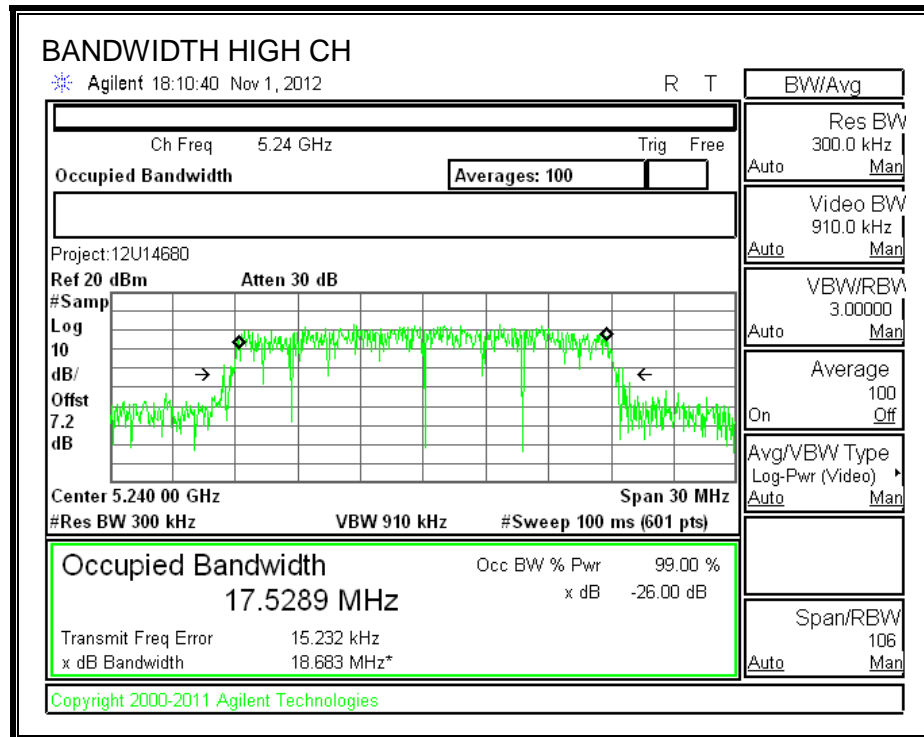
None; for reporting purposes only.

RESULTS

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|--------------------|------------------------|
| Low | 5180 | 17.5354 |
| Mid | 5200 | 17.5227 |
| High | 5240 | 17.5289 |

99% BANDWIDTH





8.2.3. 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 10.9 dB (including 10 dB pad and 0.9 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

| Channel | Frequency (MHz) | Power (dBm) |
|---------|--------------------|----------------|
| Low | 5180 | 14.0 |
| Mid | 5200 | 14.0 |
| High | 5240 | 14.0 |

8.2.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Antenna Gain

| Channel | Frequency (MHz) | Directional Gain (dBi) |
|---------|--------------------|------------------------------|
| Low | 5180 | 3.93 |
| Mid | 5200 | 3.93 |
| High | 5240 | 3.93 |

Limits

| Channel | Frequency (MHz) | FCC Power Limit (dBm) | FCC PPSD Limit (dBm) |
|---------|--------------------|--------------------------------|-------------------------------|
| Low | 5180 | 24.00 | 11.00 |
| Mid | 5200 | 24.00 | 11.00 |
| High | 5240 | 24.00 | 11.00 |

| | | |
|--------------------|------|---|
| Duty Cycle CF (dB) | 0.00 | Included in Calculations of Corr'd Power & PPSP |
|--------------------|------|---|

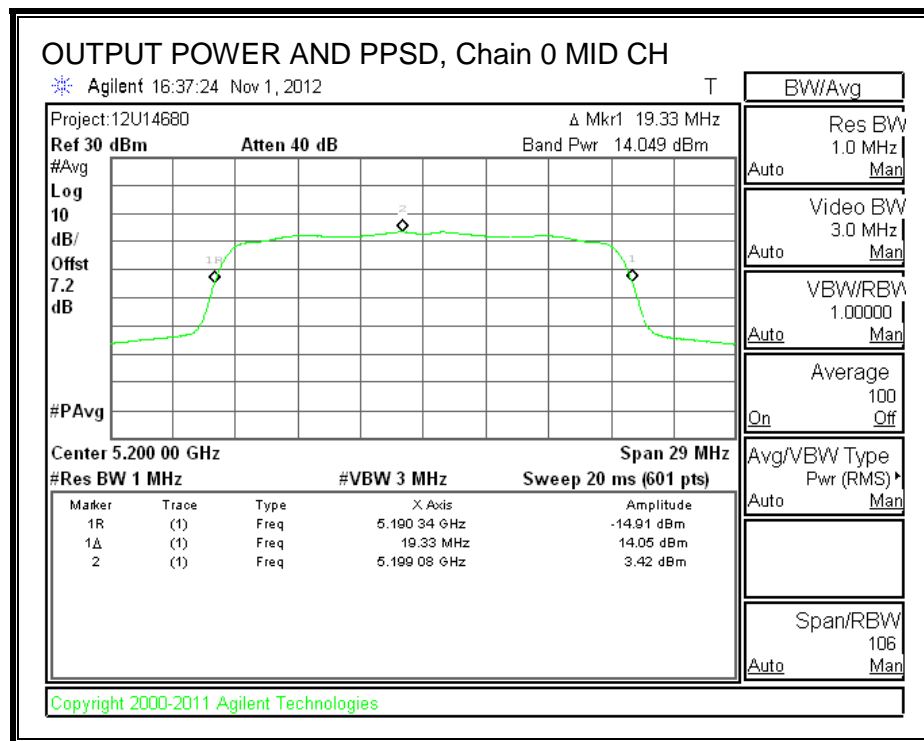
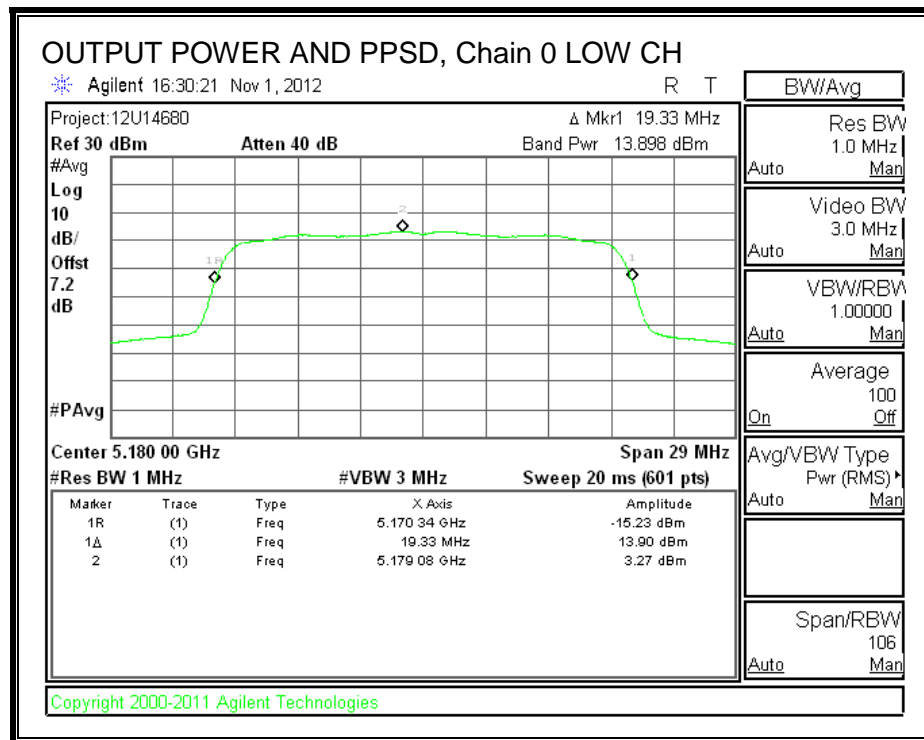
Output Power Results

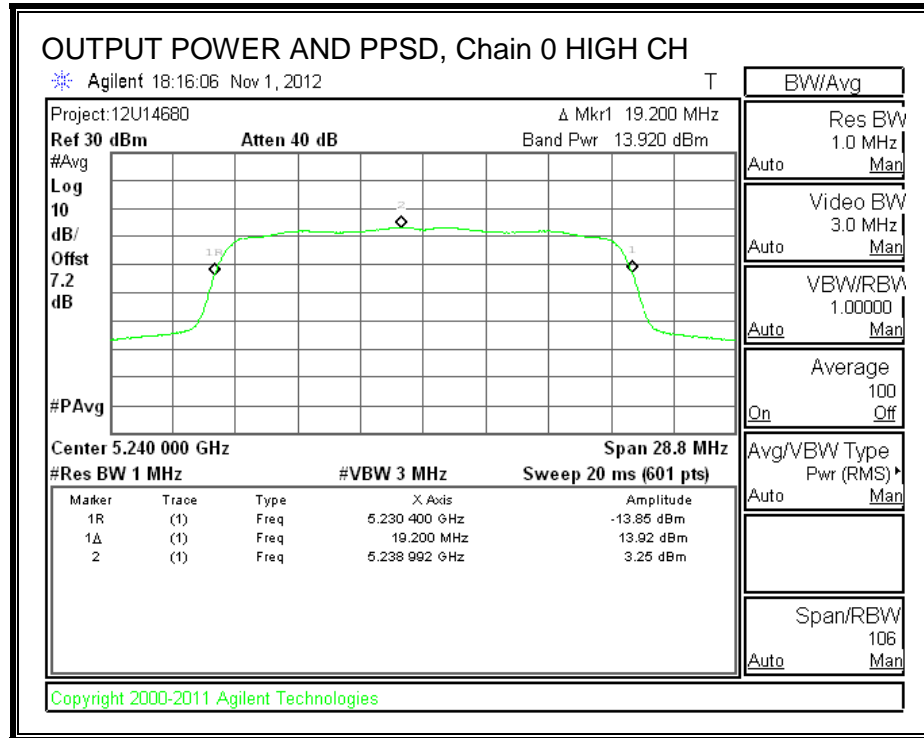
| Channel | Frequency (MHz) | Chain 0 Meas Power (dBm) | Total Corr'd Power (dBm) | Power Limit (dBm) | Power Margin (dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-------------------------|-------------------------|
| Low | 5180 | 13.90 | 13.90 | 24.00 | -10.10 |
| Mid | 5200 | 14.05 | 14.05 | 24.00 | -9.95 |
| High | 5240 | 13.92 | 13.92 | 24.00 | -10.08 |

PPSD Results

| Channel | Frequency (MHz) | Chain 0 Meas PPSD (dBm) | Total Corr'd PPSD (dBm) | PPSD Limit (dBm) | PPSD Margin (dB) |
|---------|--------------------|----------------------------------|----------------------------------|------------------------|------------------------|
| Low | 5180 | 3.27 | 3.27 | 11.00 | -7.73 |
| Mid | 5200 | 3.42 | 3.42 | 11.00 | -7.58 |
| High | 5240 | 3.25 | 3.25 | 11.00 | -7.75 |

OUTPUT POWER AND PPSD, Chain 0





8.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND

8.3.1. 26 dB BANDWIDTH

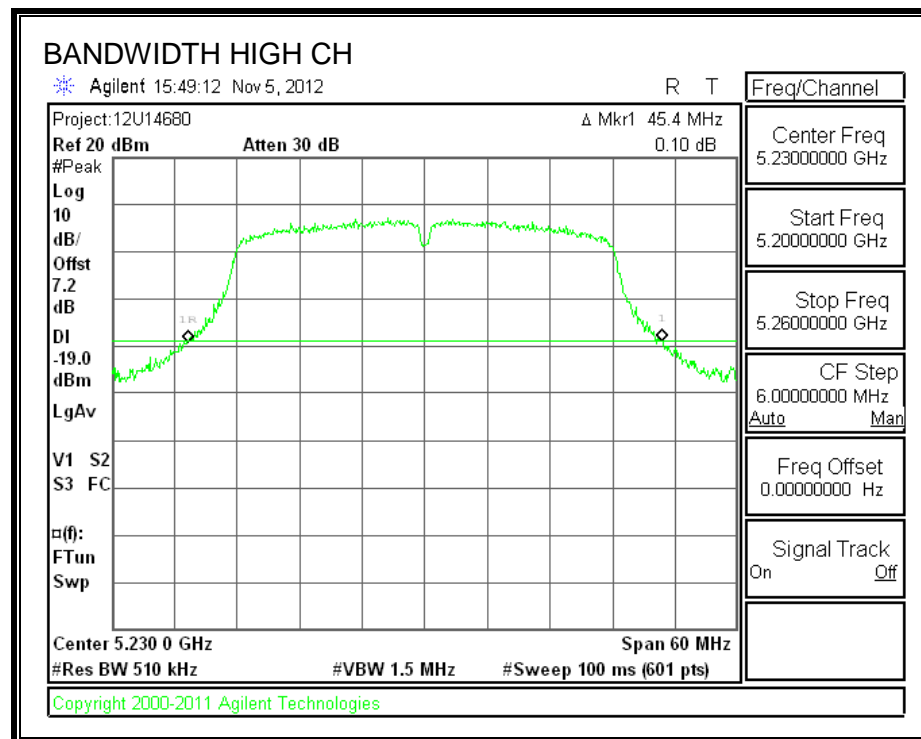
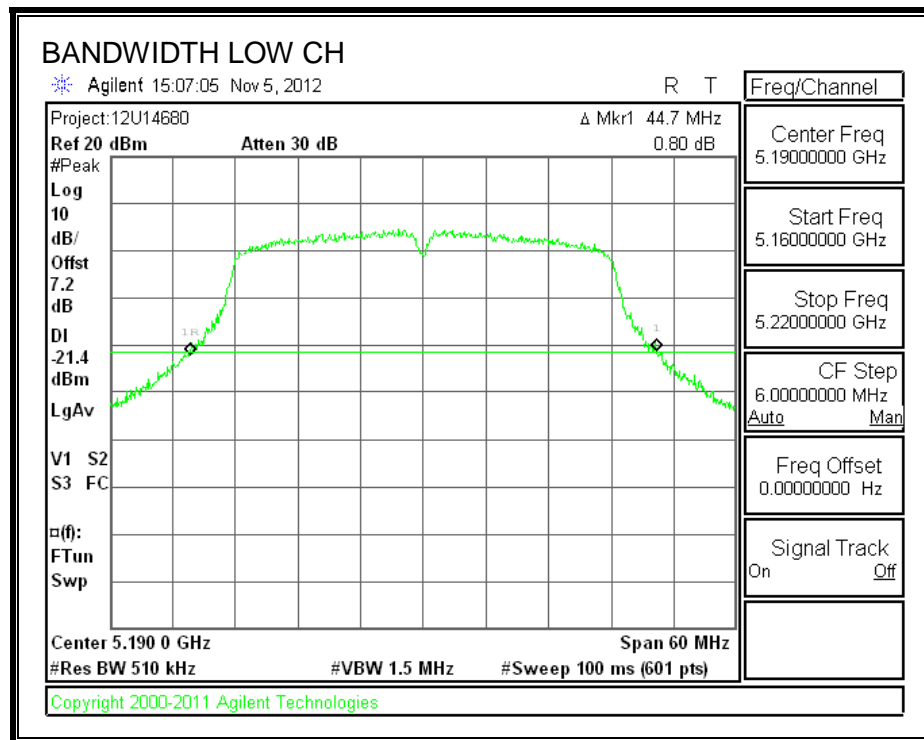
LIMITS

None; for reporting purposes only.

RESULTS

| Channel | Frequency (MHz) | 26 dB Bandwidth (MHz) |
|---------|--------------------|--------------------------|
| Low | 5190 | 44.7 |
| High | 5230 | 45.4 |

26 dB BANDWIDTH



8.3.2. 99% BANDWIDTH

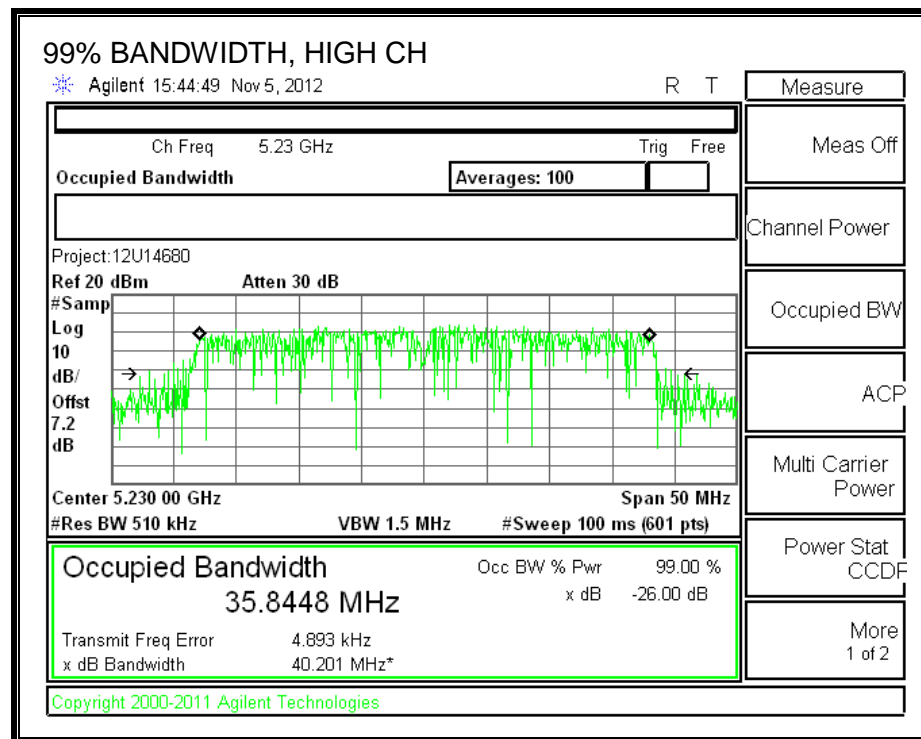
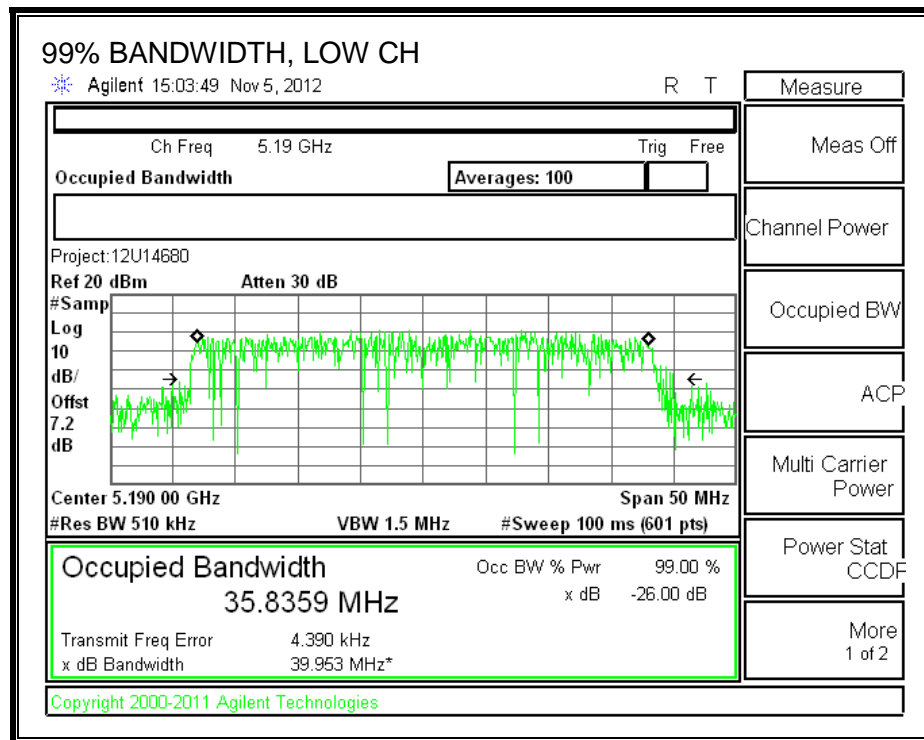
LIMITS

None; for reporting purposes only.

RESULTS

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|--------------------|------------------------|
| Low | 5190 | 35.8359 |
| High | 5230 | 35.8448 |

99% BANDWIDTH



8.3.3. 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 10.9 dB (including 10 dB pad and 0.9 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

| Channel | Frequency (MHz) | Power (dBm) |
|---------|--------------------|----------------|
| Low | 5190 | 12.5 |
| High | 5230 | 15.5 |

8.3.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Antenna Gain

| Channel | Frequency (MHz) | Directional Gain (dBi) |
|---------|--------------------|------------------------------|
| Low | 5190 | 3.93 |
| High | 5230 | 3.93 |

Limits

| Channel | Frequency (MHz) | FCC Power Limit (dBm) | FCC PPSD Limit (dBm) |
|---------|--------------------|--------------------------------|-------------------------------|
| Low | 5190 | 24.00 | 11.00 |
| High | 5230 | 24.00 | 11.00 |

| | | |
|--------------------|------|--|
| Duty Cycle CF (dB) | 0.00 | Included in Calculations of Corr'd Power & PSD |
|--------------------|------|--|

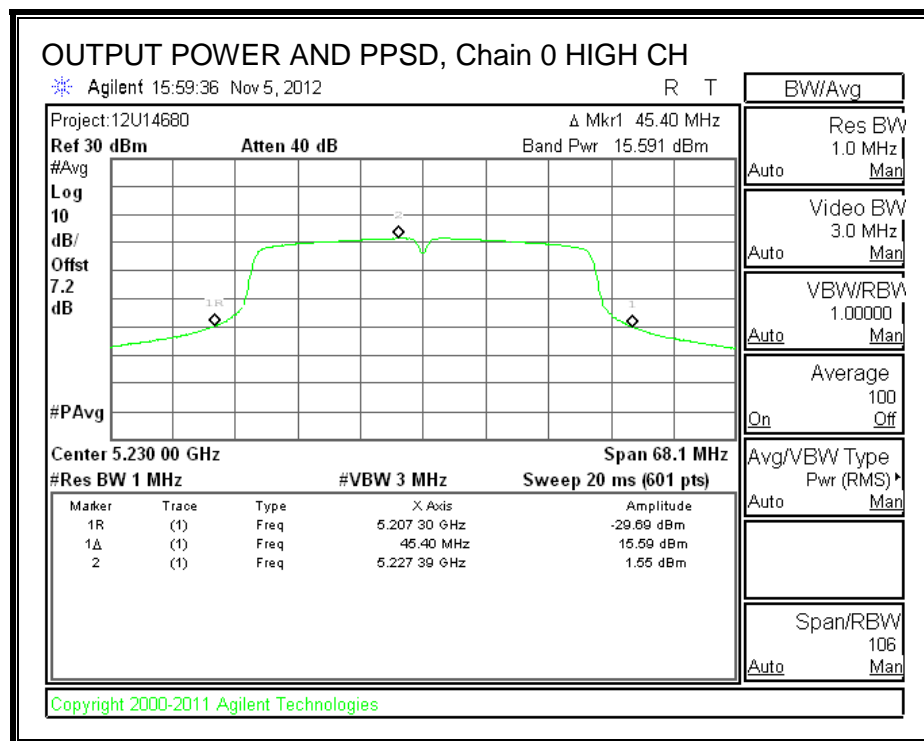
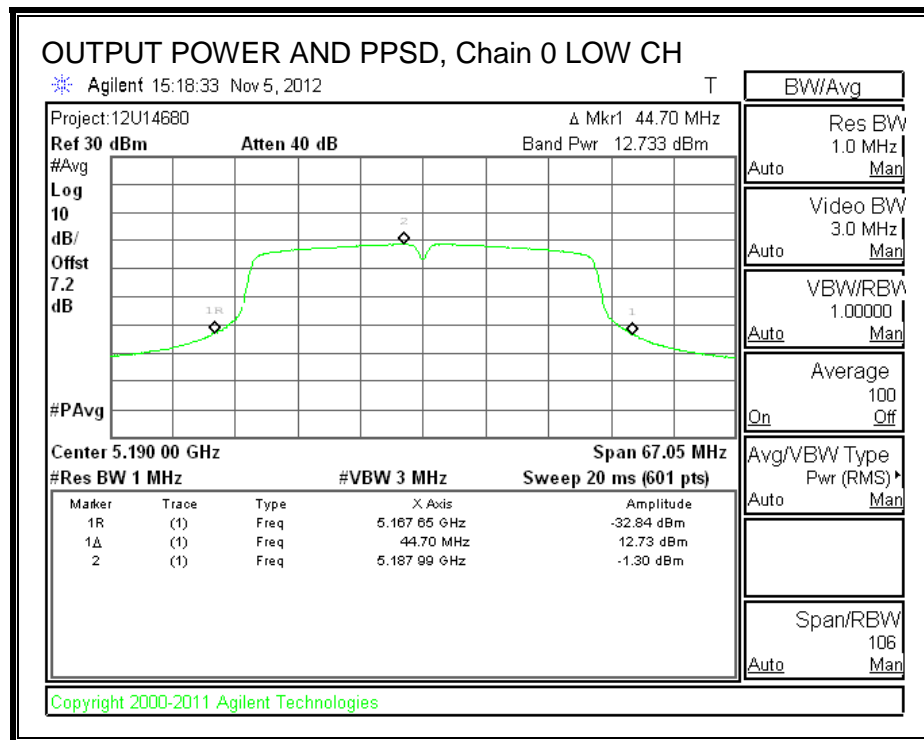
Output Power Results

| Channel | Frequency (MHz) | Chain 0 Meas Power (dBm) | Total Corr'd Power (dBm) | Power Limit (dBm) | Power Margin (dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-------------------------|-------------------------|
| Low | 5190 | 12.73 | 12.73 | 24.00 | -11.27 |
| High | 5230 | 15.59 | 15.59 | 24.00 | -8.41 |

PPSD Results

| Channel | Frequency (MHz) | Chain 0 Meas PPSD (dBm) | Total Corr'd PPSD (dBm) | PPSD Limit (dBm) | PPSD Margin (dB) |
|---------|--------------------|----------------------------------|----------------------------------|------------------------|------------------------|
| Low | 5190 | -1.30 | -1.30 | 11.00 | -12.30 |
| High | 5230 | 1.55 | 1.55 | 11.00 | -9.45 |

OUTPUT POWER AND PPSD, Chain 0



8.4. 802.11a MODE IN THE 5.3 GHz BAND

8.4.1. 26 dB BANDWIDTH

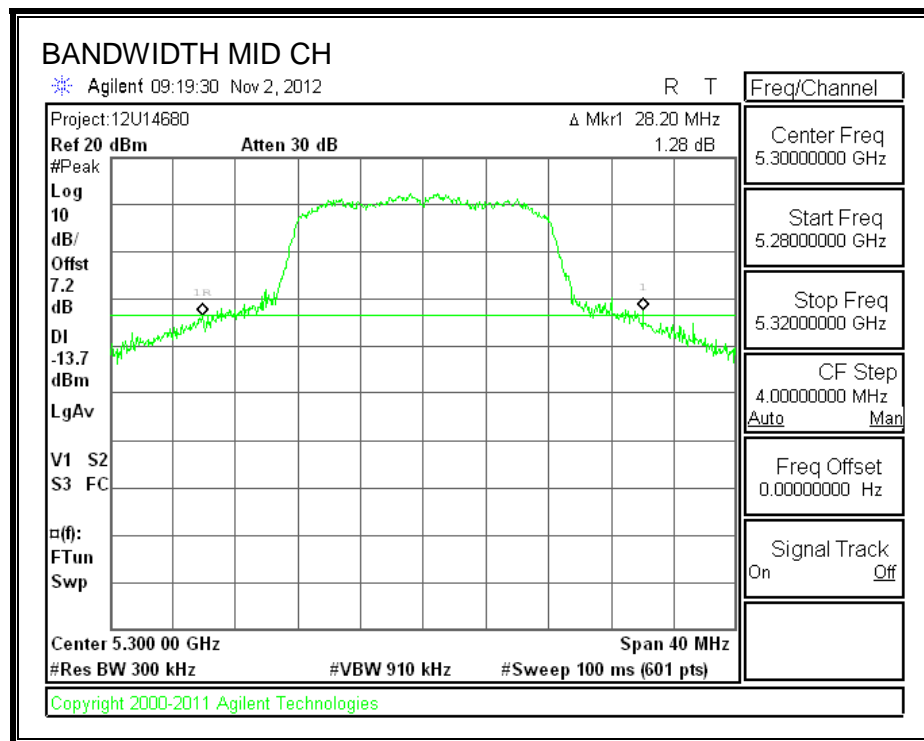
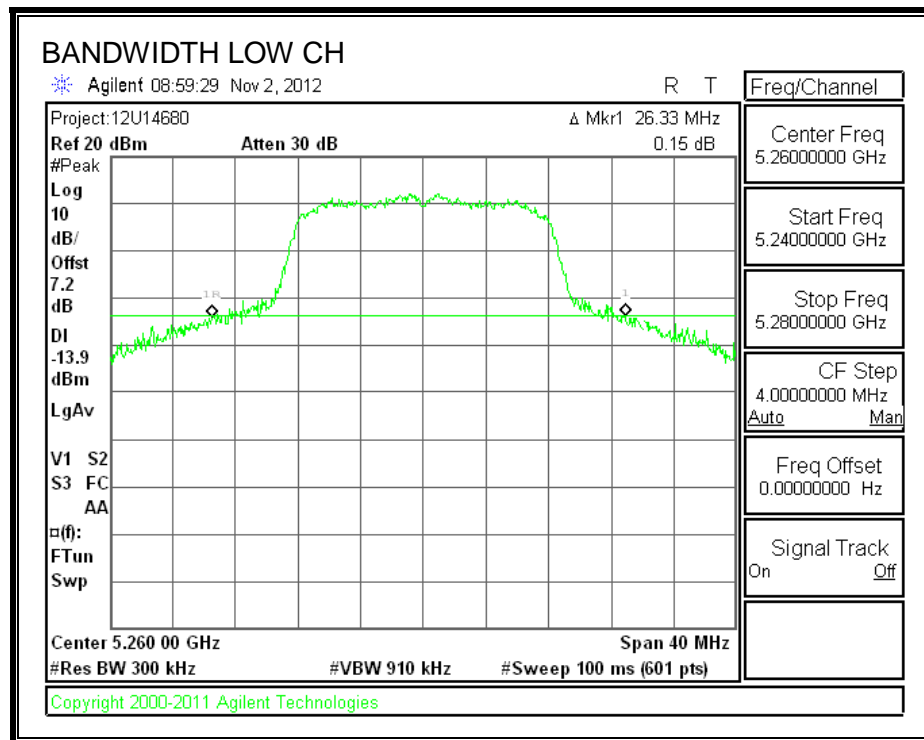
LIMITS

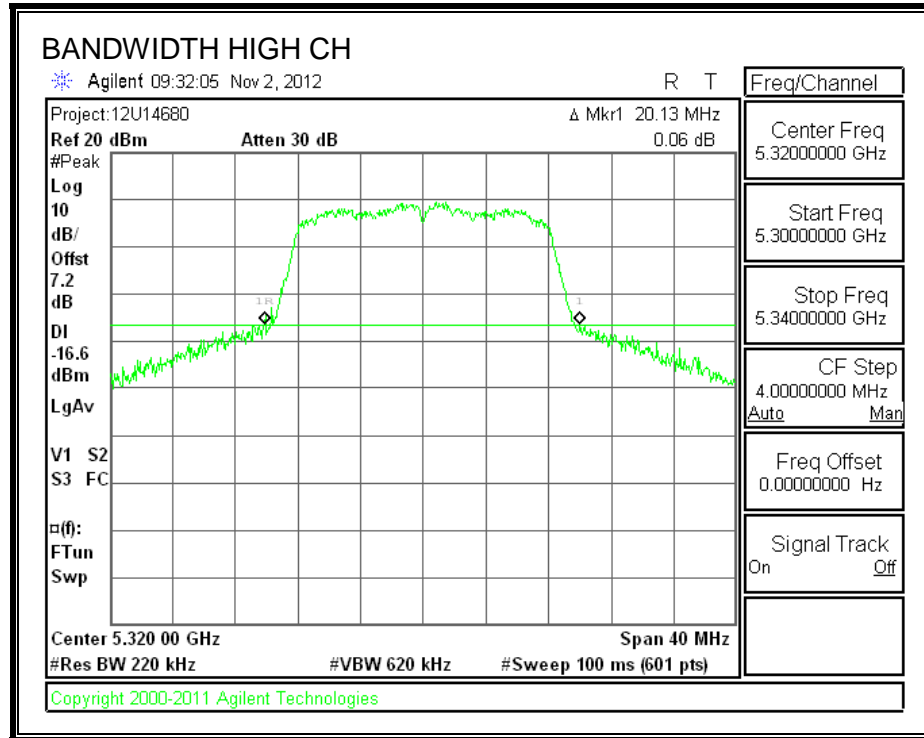
None; for reporting purposes only.

RESULTS

| Channel | Frequency (MHz) | 26 dB Bandwidth (MHz) |
|---------|--------------------|--------------------------|
| Low | 5260 | 26.33 |
| Mid | 5300 | 28.20 |
| High | 5320 | 20.13 |

26 dB BANDWIDTH





8.4.2. 99% BANDWIDTH

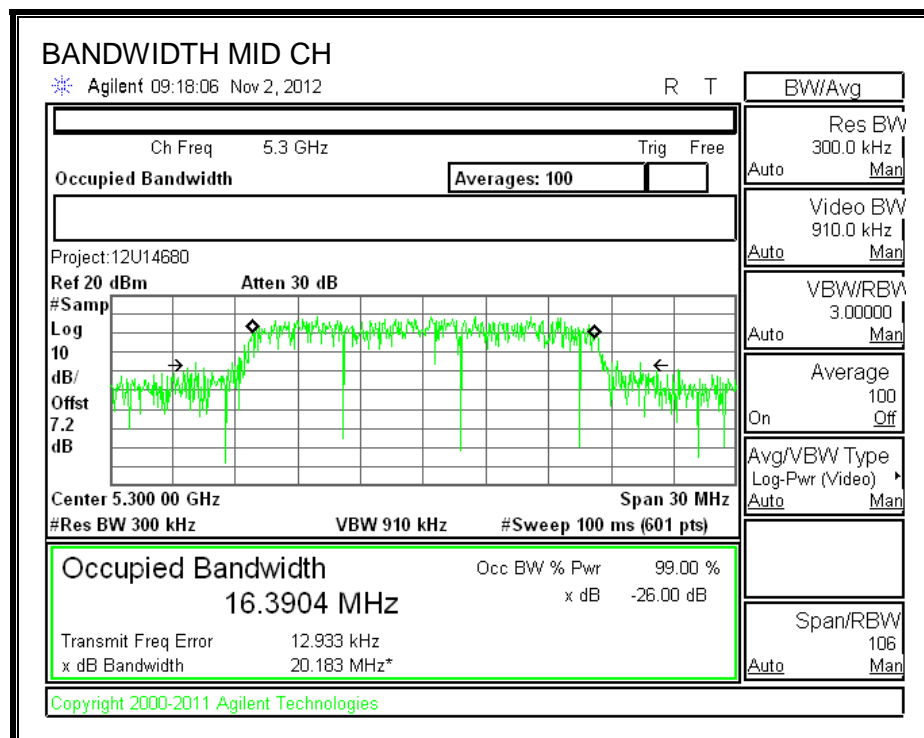
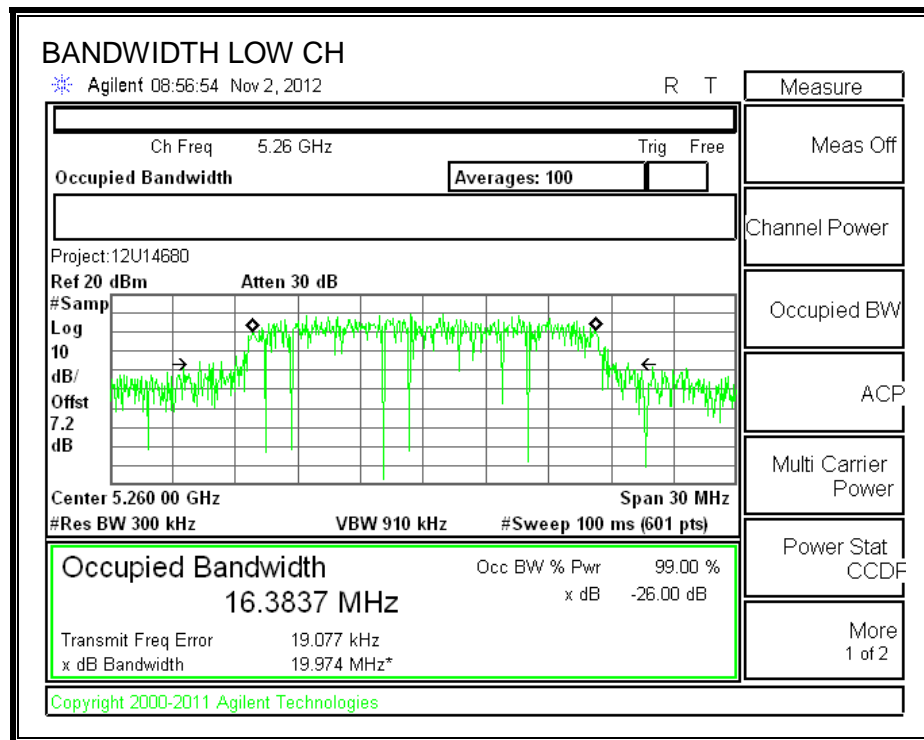
LIMITS

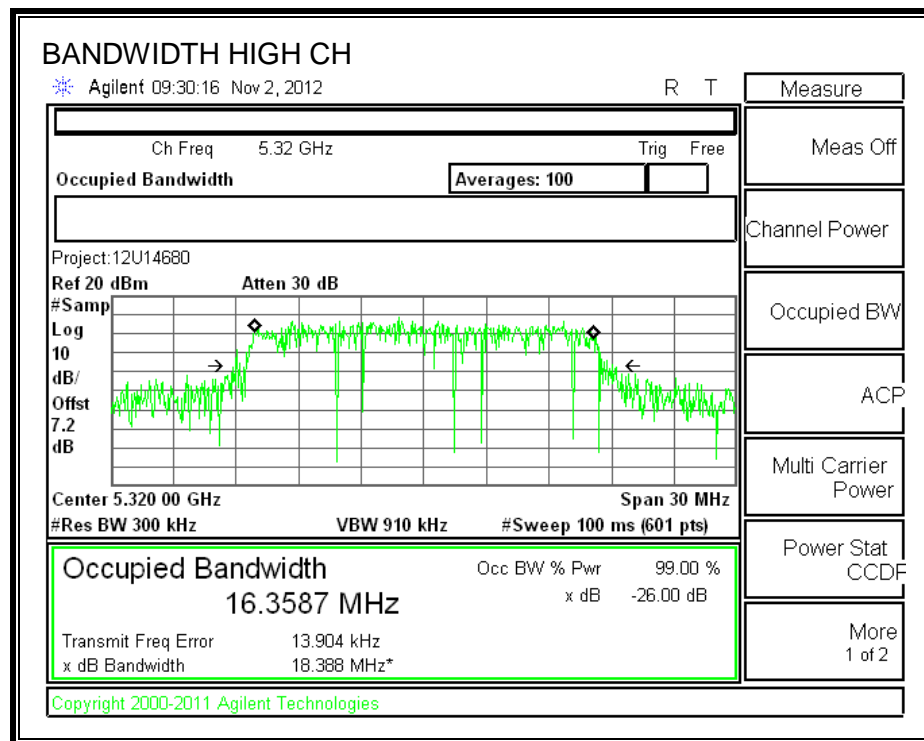
None; for reporting purposes only.

RESULTS

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|--------------------|------------------------|
| Low | 5260 | 16.3837 |
| Mid | 5300 | 16.3904 |
| High | 5320 | 16.3587 |

99% BANDWIDTH





8.4.3. 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 10.9 dB (including 10 dB pad and 0.9 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

| Channel | Frequency (MHz) | Power (dBm) |
|---------|--------------------|----------------|
| Low | 5260 | 19.5 |
| Mid | 5300 | 19.5 |
| High | 5320 | 18.0 |

8.4.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (2)

For the band 5.25–5.35 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. In addition, the maximum 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 maximum conducted output 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.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Bandwidth and Antenna Gain

| Channel | Frequency (MHz) | Min 26 dB BW (MHz) | Directio Gain (dBi) |
|---------|--------------------|-----------------------------|---------------------------|
| Low | 5260 | 26.33 | 3.16 |
| Mid | 5300 | 28.20 | 3.16 |
| High | 5320 | 20.13 | 3.16 |

Limits

| Channel | Frequency (MHz) | FCC Power Limit (dBm) | FCC PPSD Limit (dBm) |
|---------|--------------------|--------------------------------|-------------------------------|
| Low | 5260 | 24.00 | 11.00 |
| Mid | 5300 | 24.00 | 11.00 |
| High | 5320 | 24.00 | 11.00 |

| | | |
|--------------------|------|--|
| Duty Cycle CF (dB) | 0.00 | Included in Calculations of Corr'd Power &PPSD |
|--------------------|------|--|

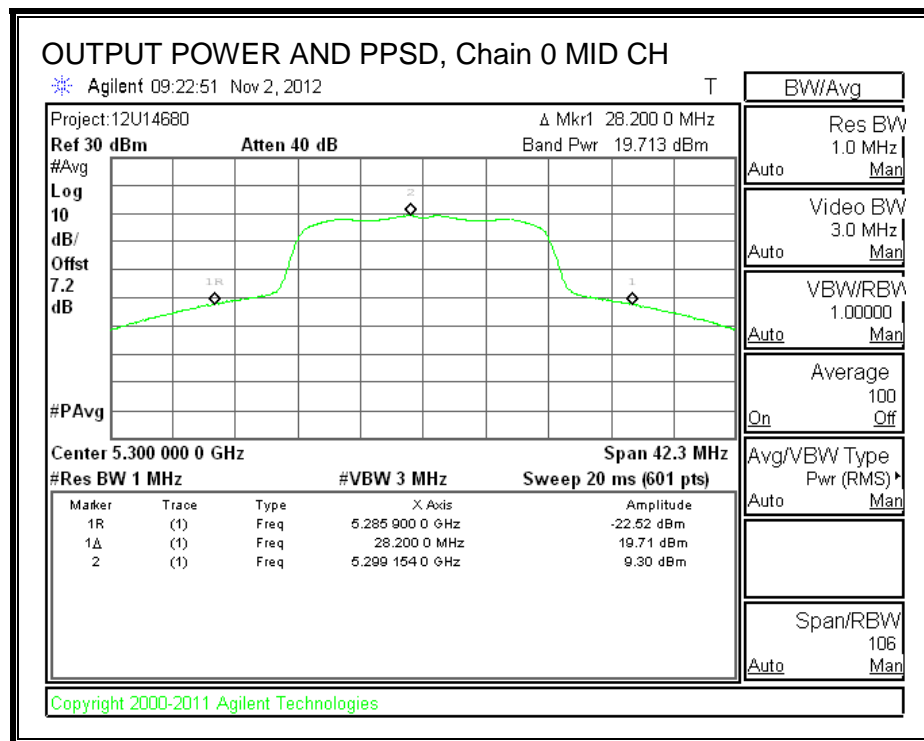
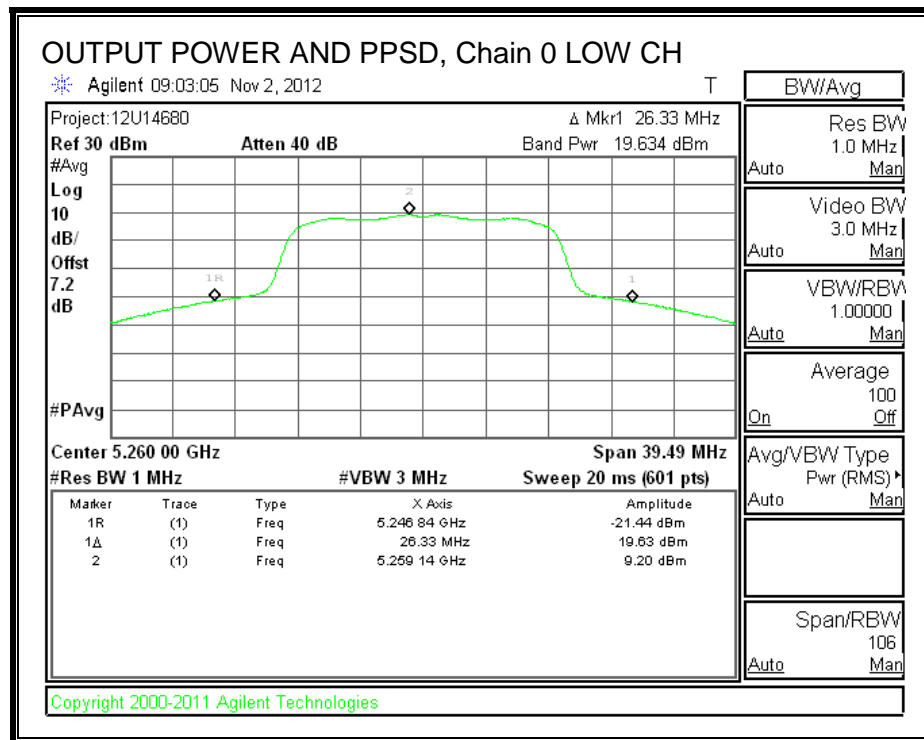
Output Power Results

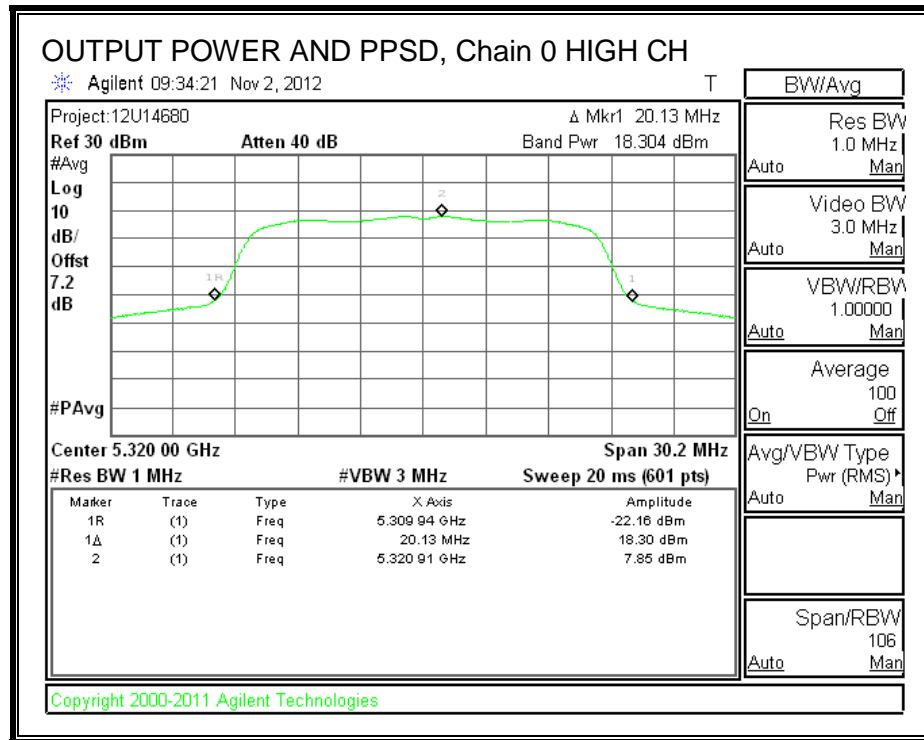
| Channel | Frequency (MHz) | Chain 0 Meas Power (dBm) | Total Corr'd Power (dBm) | Power Limit (dBm) | Power Margin (dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-------------------------|-------------------------|
| Low | 5260 | 19.63 | 19.63 | 24.00 | -4.37 |
| Mid | 5300 | 19.71 | 19.71 | 24.00 | -4.29 |
| High | 5320 | 18.30 | 18.30 | 24.00 | -5.70 |

PPSD Results

| Channel | Frequency (MHz) | Chain 0 Meas PPSD (dBm) | Total Corr'd PPSD (dBm) | PPSD Limit (dBm) | PPSD Margin (dB) |
|---------|--------------------|----------------------------------|----------------------------------|------------------------|------------------------|
| Low | 5260 | 9.20 | 9.20 | 11.00 | -1.80 |
| Mid | 5300 | 9.29 | 9.29 | 11.00 | -1.71 |
| High | 5320 | 7.85 | 7.85 | 11.00 | -3.15 |

OUTPUT POWER AND PPSD, Chain 0





8.4.5. TPC POWER

LIMITS

FCC §15.407 (h) (1)

Transmit power control (TPC). U-NII devices operating in the 5.25–5.35 GHz band and the 5.47–5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

EIRP is less than 27 dBm; therefore, TPC is not required.

8.5. 802.11n HT20 MODE IN THE 5.3 GHz BAND

8.5.1. 26 dB BANDWIDTH

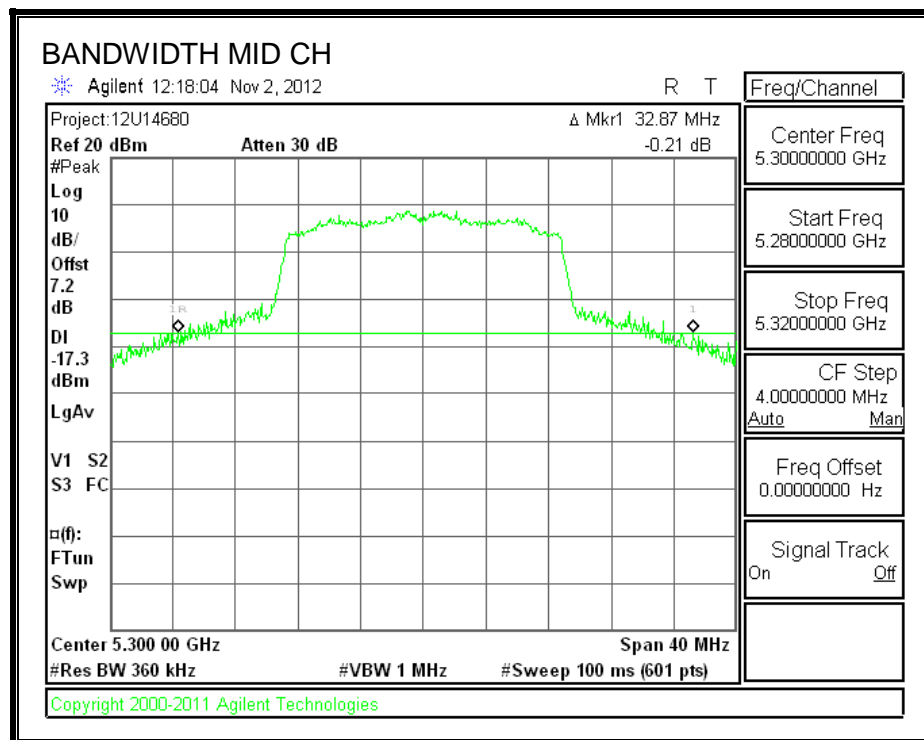
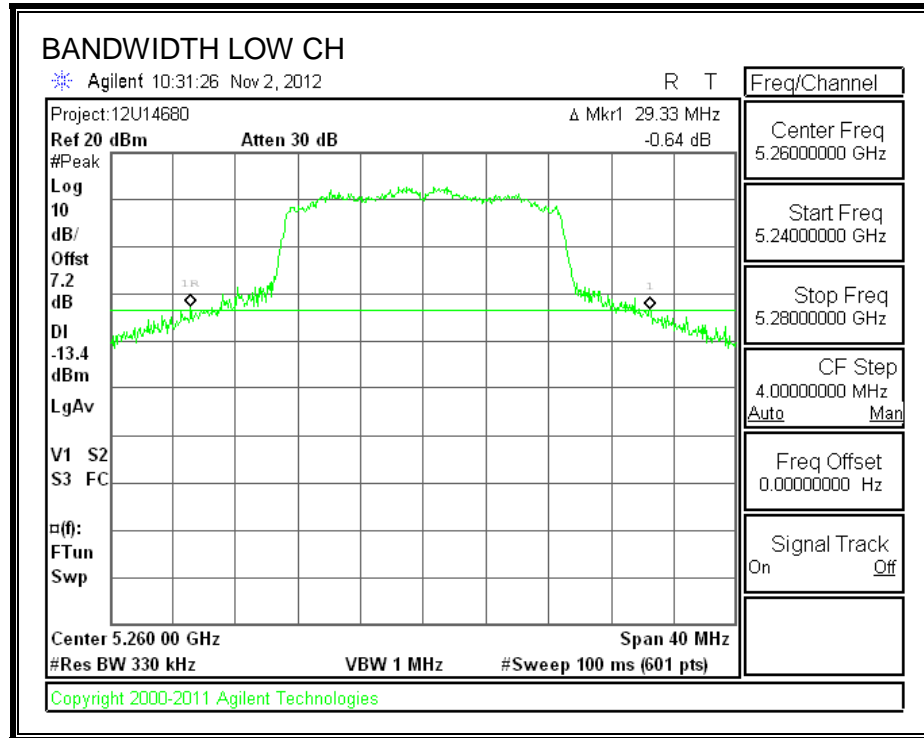
LIMITS

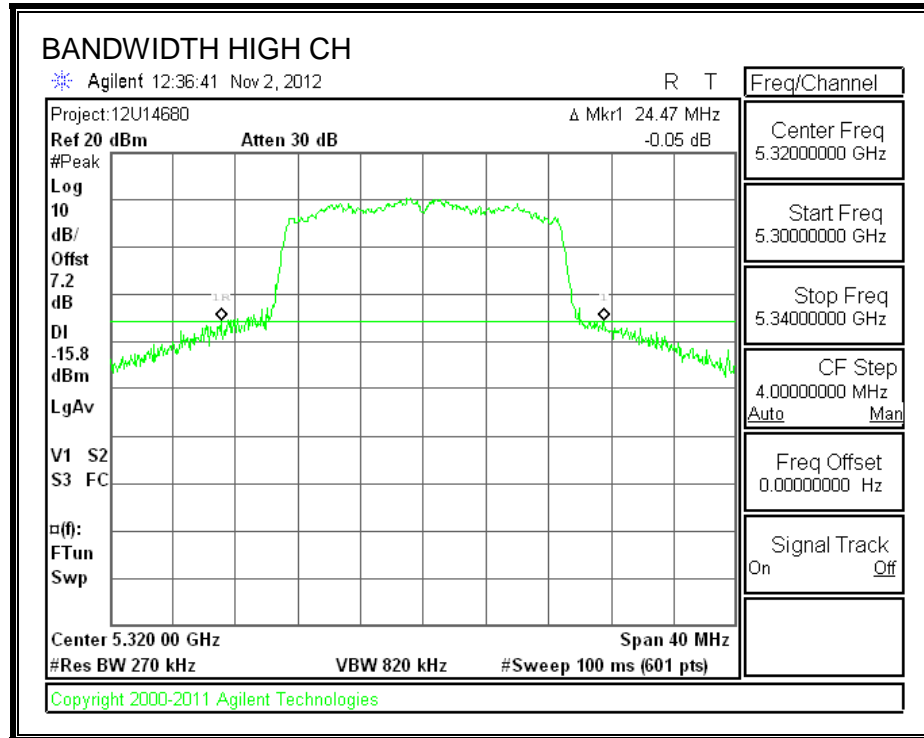
None; for reporting purposes only.

RESULTS

| Channel | Frequency (MHz) | 26 dB Bandwidth (MHz) |
|---------|--------------------|--------------------------|
| Low | 5260 | 29.33 |
| Mid | 5300 | 32.87 |
| High | 5320 | 24.47 |

26 dB BANDWIDTH





8.5.2. 99% BANDWIDTH

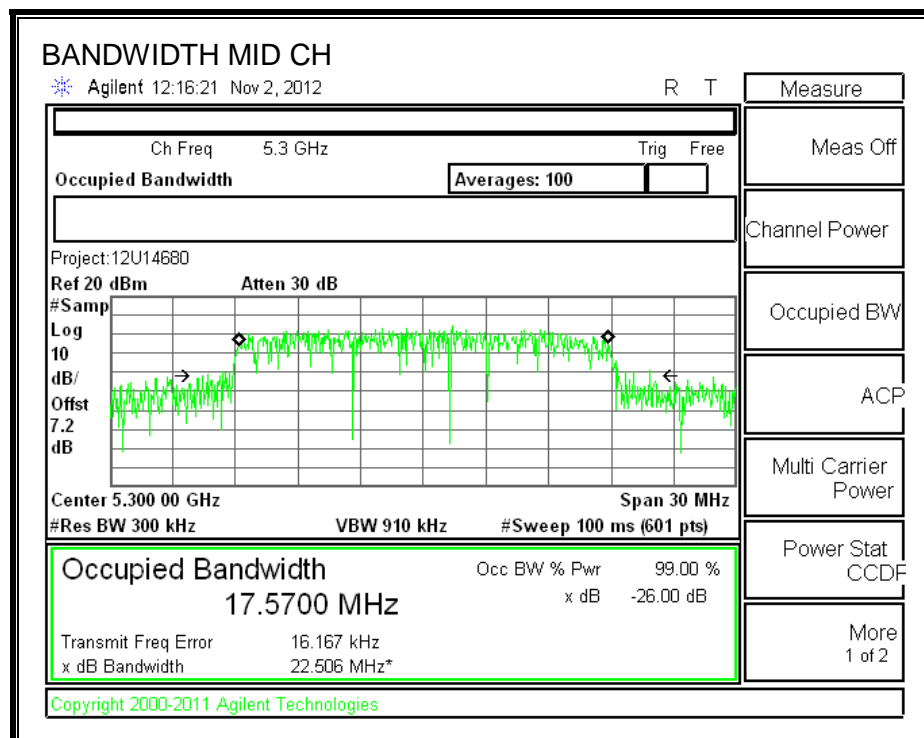
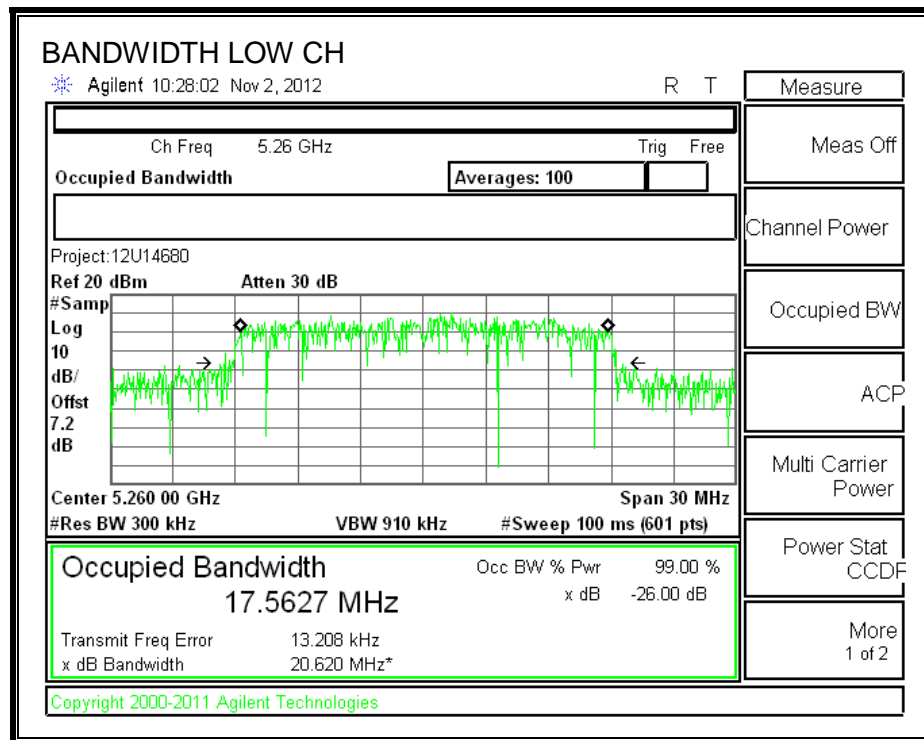
LIMITS

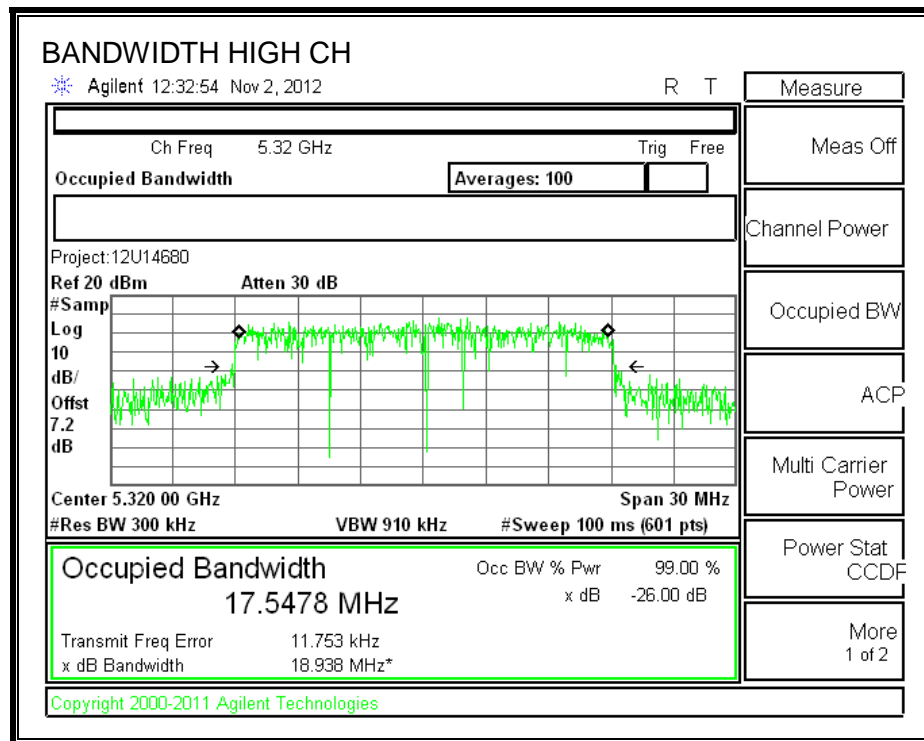
None; for reporting purposes only.

RESULTS

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|--------------------|------------------------|
| Low | 5260 | 17.5627 |
| Mid | 5300 | 17.5700 |
| High | 5320 | 17.5478 |

99% BANDWIDTH





8.5.3. 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 10.9 dB (including 10 dB pad and 0.9 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

| Channel | Frequency (MHz) | Power (dBm) |
|---------|--------------------|----------------|
| Low | 5260 | 19.5 |
| Mid | 5300 | 19.5 |
| High | 5320 | 18.0 |

8.5.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (2)

For the band 5.25–5.35 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. In addition, the maximum 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 maximum conducted output 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.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Bandwidth and Antenna Gain

| Channel | Frequency (MHz) | Min 26 dB BW (MHz) | Directional Gain (dBi) |
|---------|--------------------|-----------------------------|------------------------------|
| Low | 5260 | 29.33 | 3.16 |
| Mid | 5300 | 32.87 | 3.16 |
| High | 5320 | 24.47 | 3.16 |

Limits

| Channel | Frequency (MHz) | FCC Power Limit (dBm) | FCC PPSD Limit (dBm) |
|---------|--------------------|--------------------------------|-------------------------------|
| Low | 5260 | 24.00 | 11.00 |
| Mid | 5300 | 24.00 | 11.00 |
| High | 5320 | 24.00 | 11.00 |

| | | |
|--------------------|------|---|
| Duty Cycle CF (dB) | 0.00 | Included in Calculations of Corr'd Power & PPSP |
|--------------------|------|---|

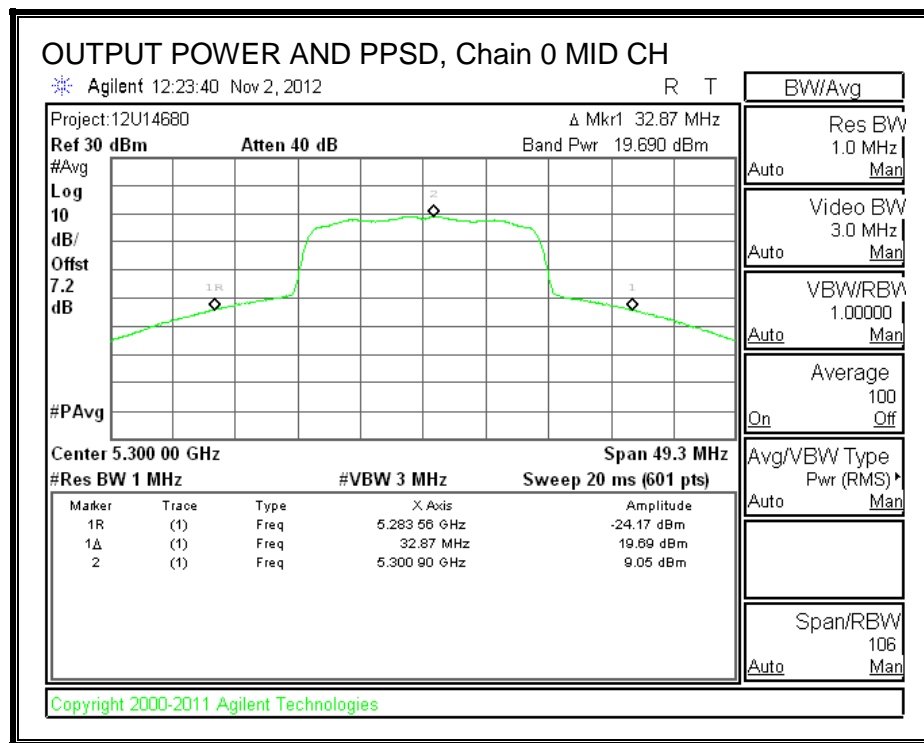
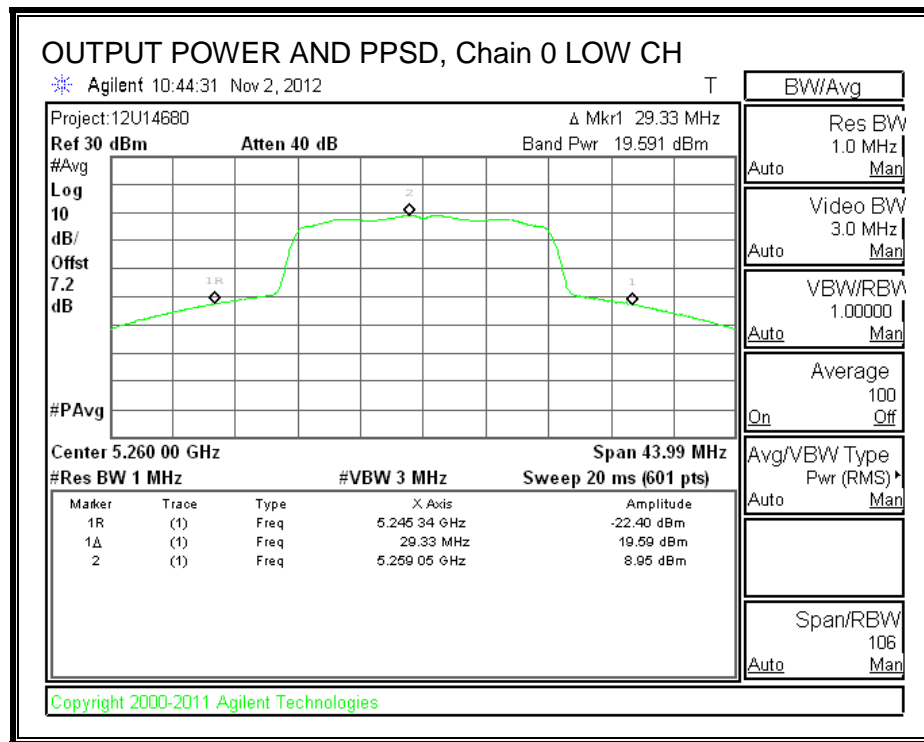
Output Power Results

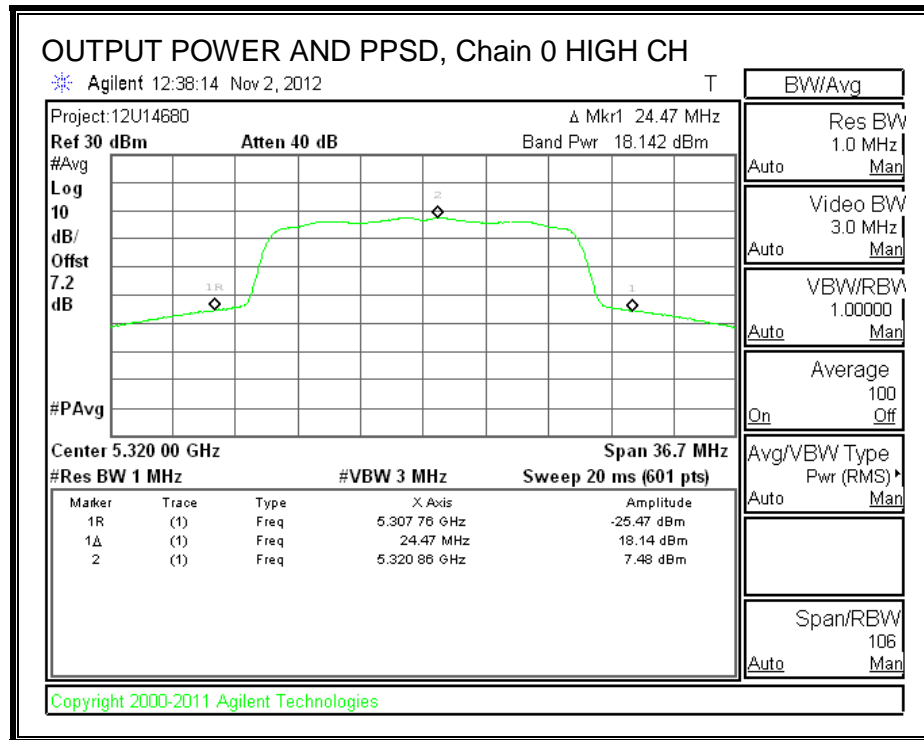
| Channel | Frequency (MHz) | Chain 0 Meas Power (dBm) | Total Corr'd Power (dBm) | Power Limit (dBm) | Power Margin (dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-------------------------|-------------------------|
| Low | 5260 | 19.59 | 19.59 | 24.00 | -4.41 |
| Mid | 5300 | 19.69 | 19.69 | 24.00 | -4.31 |
| High | 5320 | 18.14 | 18.14 | 24.00 | -5.86 |

PPSD Results

| Channel | Frequency (MHz) | Chain 0 Meas PPSD (dBm) | Total Corr'd PPSD (dBm) | PPSD Limit (dBm) | PPSD Margin (dB) |
|---------|--------------------|----------------------------------|----------------------------------|------------------------|------------------------|
| Low | 5260 | 8.95 | 8.95 | 11.00 | -2.05 |
| Mid | 5300 | 9.05 | 9.05 | 11.00 | -1.95 |
| High | 5320 | 7.48 | 7.48 | 11.00 | -3.52 |

OUTPUT POWER AND PPSD, Chain 0





8.5.5. TPC POWER

LIMITS

FCC §15.407 (h) (1)

Transmit power control (TPC). U-NII devices operating in the 5.25–5.35 GHz band and the 5.47–5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

EIRP is less than 27 dBm; therefore, TPC is not required.

8.6. 802.11n HT40 MODE IN THE 5.3 GHz BAND

8.6.1. 26 dB BANDWIDTH

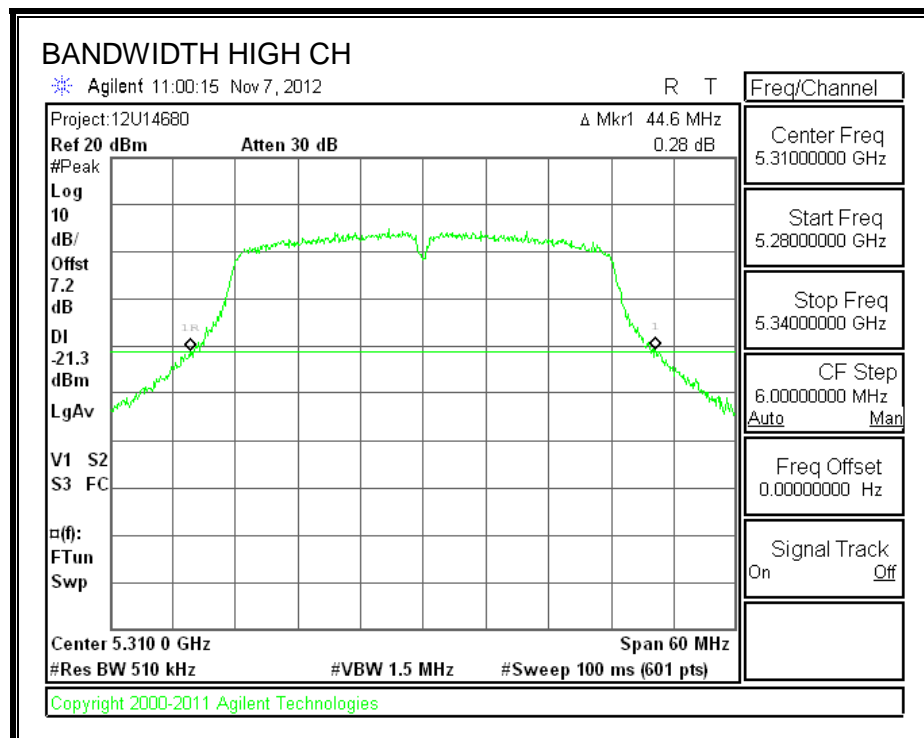
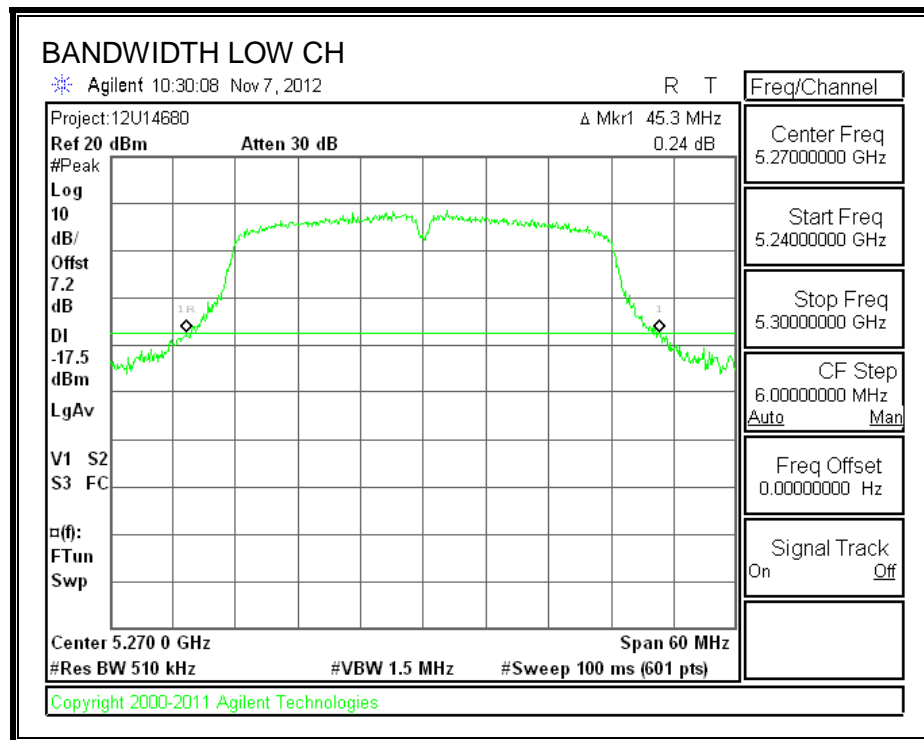
LIMITS

None; for reporting purposes only.

RESULTS

| Channel | Frequency (MHz) | 26 dB Bandwidth (MHz) |
|---------|--------------------|--------------------------|
| Low | 5270 | 45.3 |
| High | 5310 | 44.6 |

26 dB BANDWIDTH



8.6.2. 99% BANDWIDTH

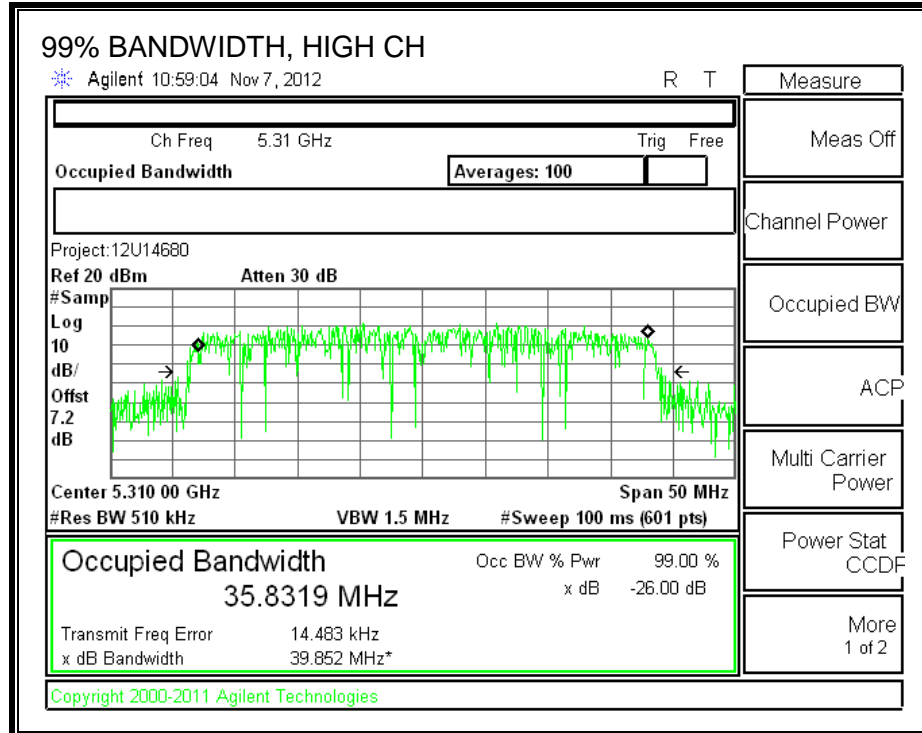
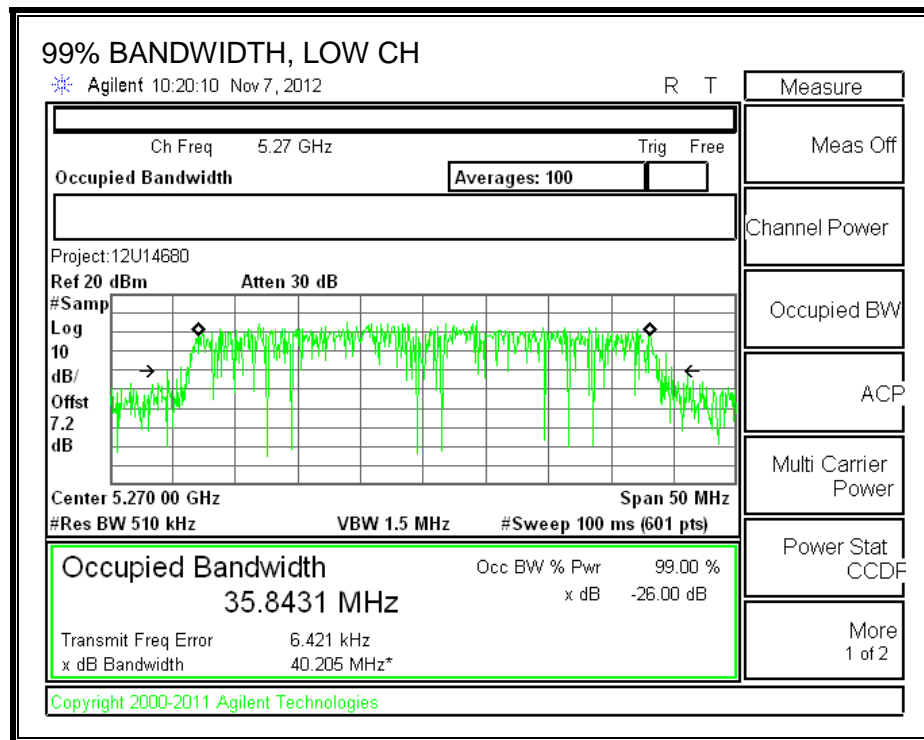
LIMITS

None; for reporting purposes only.

RESULTS

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|--------------------|------------------------|
| Low | 5270 | 35.8431 |
| High | 5310 | 35.8319 |

99% BANDWIDTH



8.6.3. 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 10.9 dB (including 10 dB pad and 0.9 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

| Channel | Frequency (MHz) | Power (dBm) |
|---------|--------------------|----------------|
| Low | 5270 | 16.0 |
| High | 5310 | 12.5 |

8.6.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (2)

For the band 5.25–5.35 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. In addition, the maximum 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 maximum conducted output 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.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Bandwidth and Antenna Gain

| Channel | Frequency (MHz) | Min 26 dB BW (MHz) | Directional Gain (dBi) |
|---------|--------------------|-----------------------------|------------------------------|
| Low | 5270 | 45.3 | 3.16 |
| High | 5310 | 44.6 | 3.16 |

Limits

| Channel | Frequency (MHz) | FCC Power Limit (dBm) | FCC PPSD Limit (dBm) |
|---------|--------------------|--------------------------------|-------------------------------|
| Low | 5270 | 24.00 | 11.00 |
| High | 5310 | 24.00 | 11.00 |

| | | |
|--------------------|------|---|
| Duty Cycle CF (dB) | 0.00 | Included in Calculations of Corr'd Power & PPSP |
|--------------------|------|---|

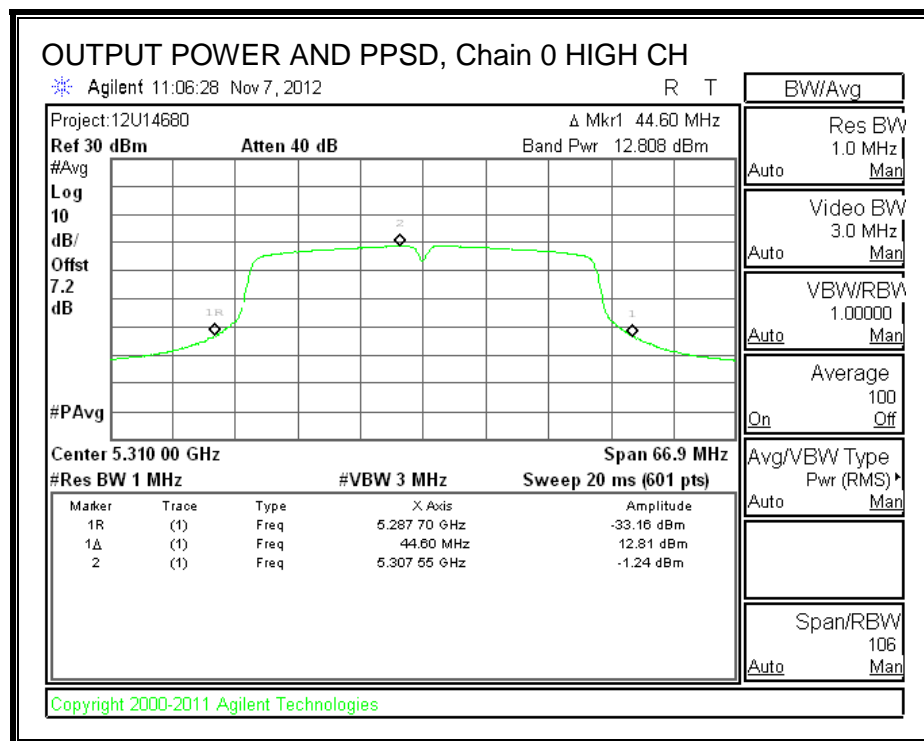
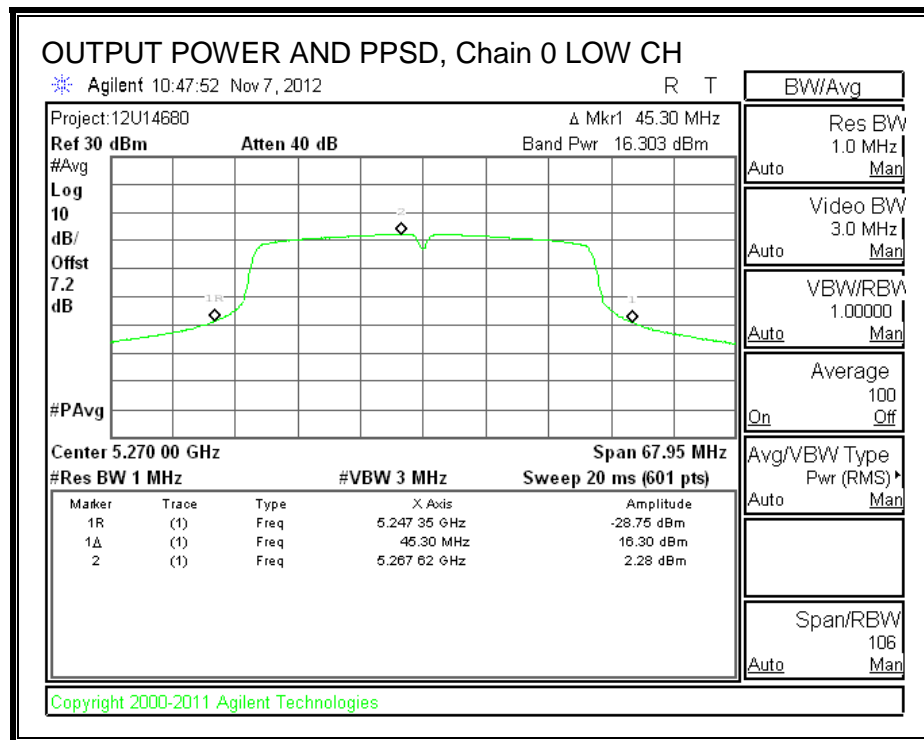
Output Power Results

| Channel | Frequency (MHz) | Chain 0 Meas Power (dBm) | Total Corr'd Power (dBm) | Power Limit (dBm) | Power Margin (dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-------------------------|-------------------------|
| Low | 5270 | 16.30 | 16.30 | 24.00 | -7.70 |
| High | 5310 | 12.81 | 12.81 | 24.00 | -11.19 |

PPSD Results

| Channel | Frequency (MHz) | Chain 0 Meas PPSD (dBm) | Total Corr'd PPSD (dBm) | PPSD Limit (dBm) | PPSD Margin (dB) |
|---------|--------------------|----------------------------------|----------------------------------|------------------------|------------------------|
| Low | 5270 | 2.28 | 2.28 | 11.00 | -8.72 |
| High | 5310 | -1.24 | -1.24 | 11.00 | -12.24 |

OUTPUT POWER AND PPSD, Chain 0



8.6.5. TPC POWER

LIMITS

FCC §15.407 (h) (1)

Transmit power control (TPC). U-NII devices operating in the 5.25–5.35 GHz band and the 5.47–5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

EIRP is less than 27 dBm; therefore, TPC is not required.

8.7. 802.11a MODE IN THE 5.6 GHz BAND

8.7.1. 26 dB BANDWIDTH

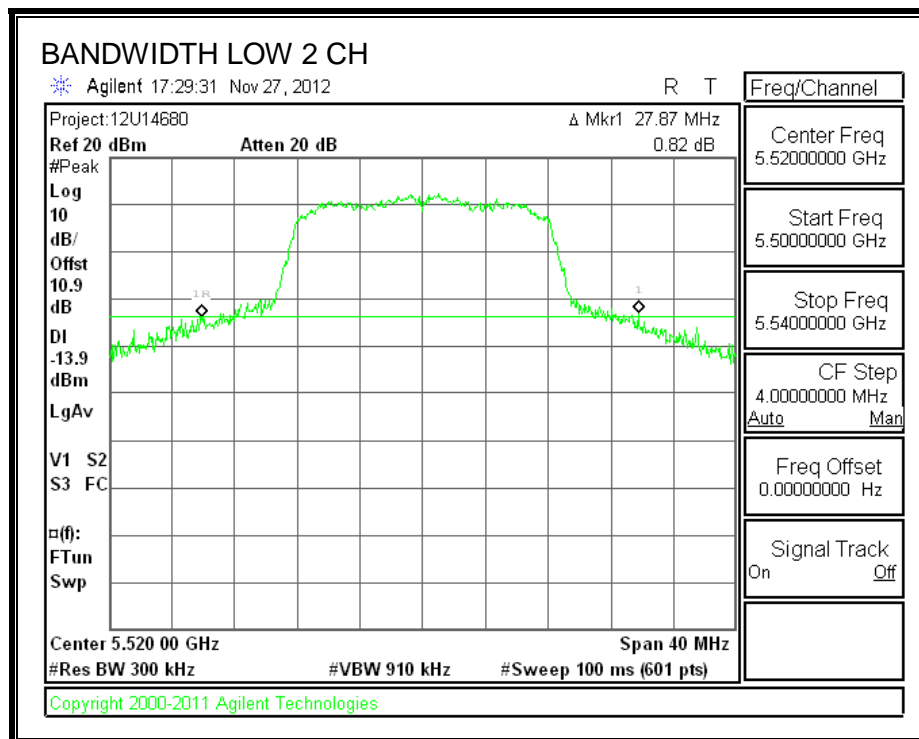
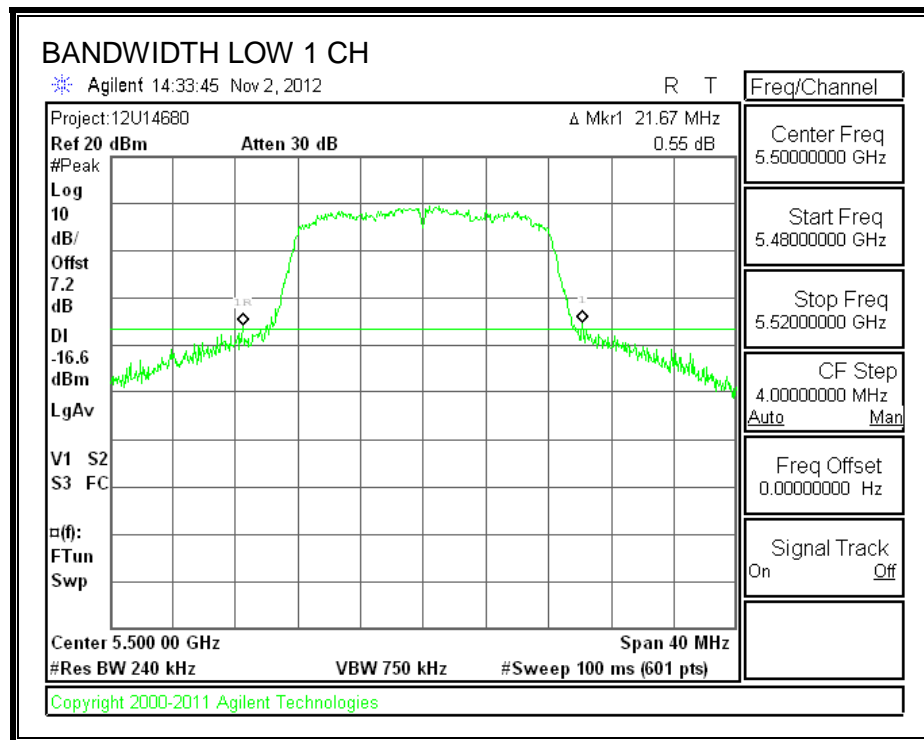
LIMITS

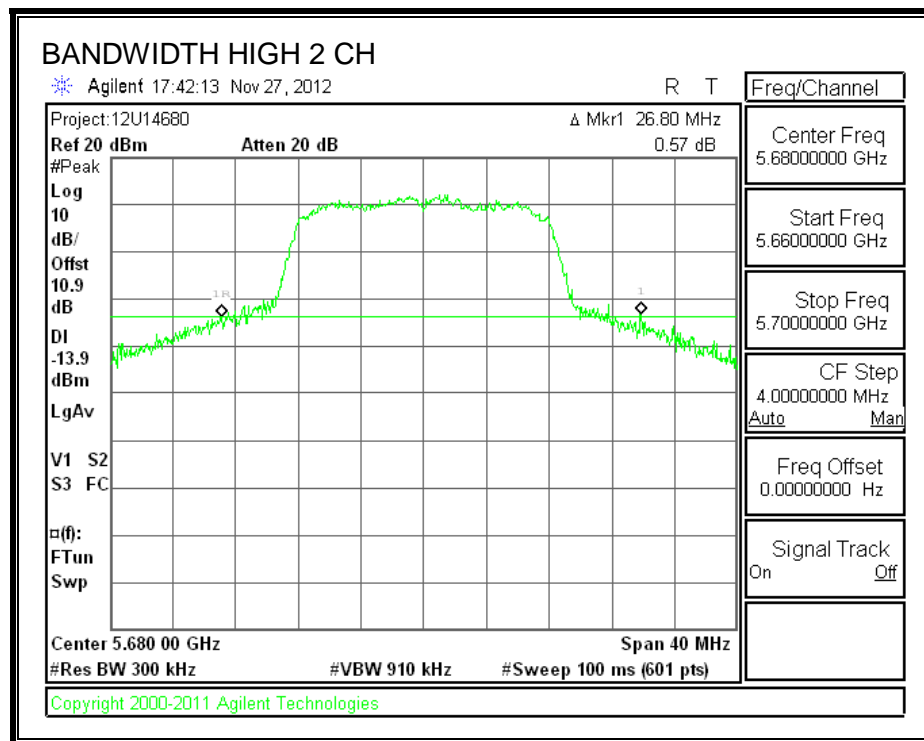
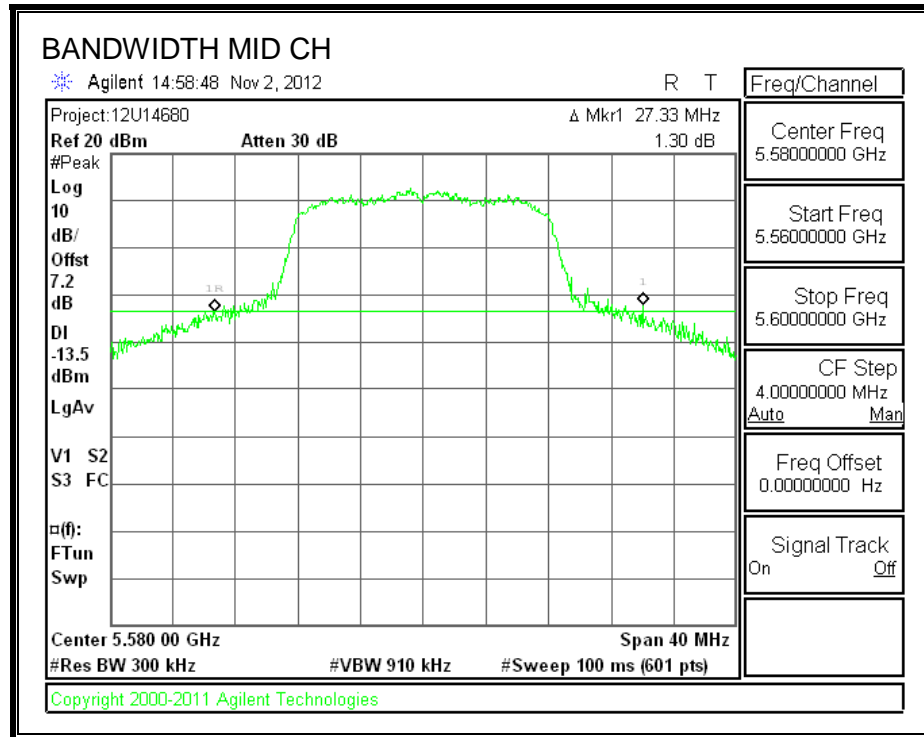
None; for reporting purposes only.

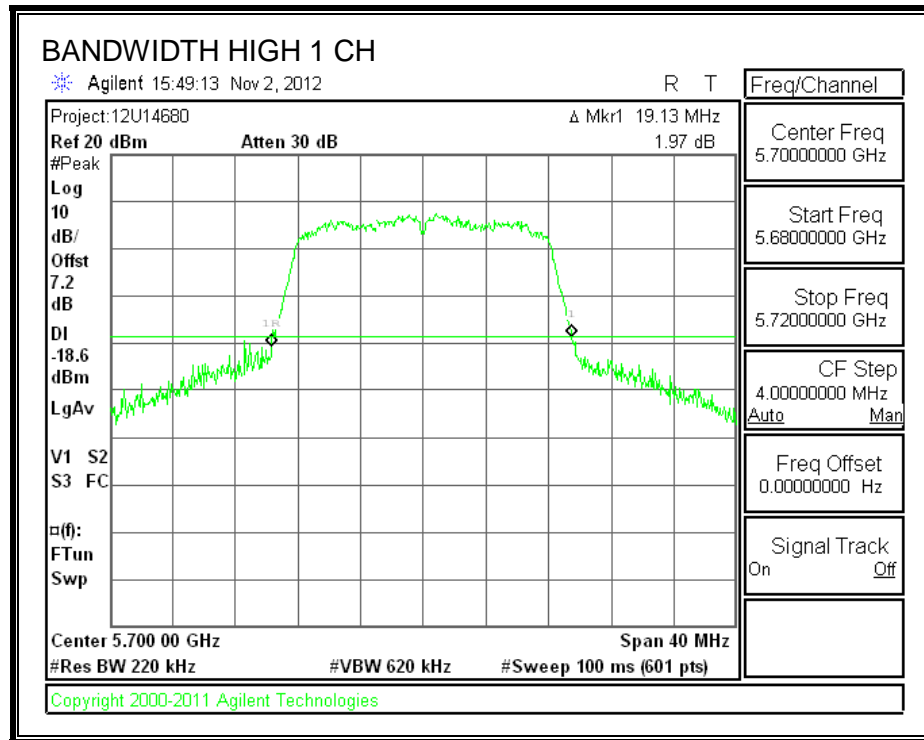
RESULTS

| Channel | Frequency (MHz) | 26 dB Bandwidth (MHz) |
|---------|--------------------|--------------------------|
| Low 1 | 5500 | 21.67 |
| Low 2 | 5520 | 27.87 |
| Mid | 5580 | 27.33 |
| High 2 | 5680 | 26.80 |
| High 1 | 5700 | 19.13 |

26 dB BANDWIDTH







8.7.2. 99% BANDWIDTH

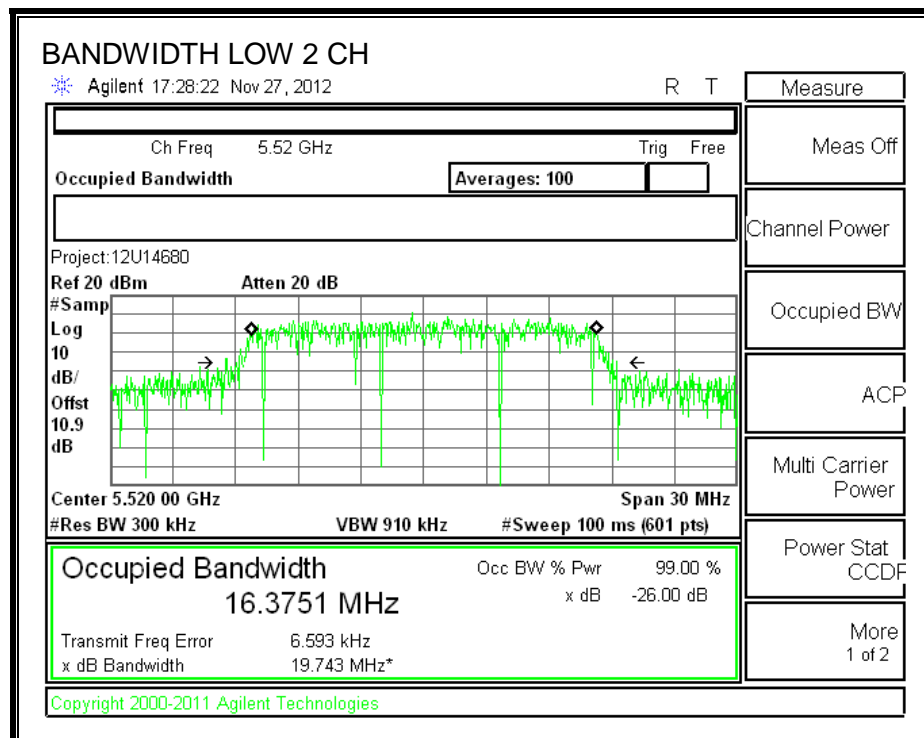
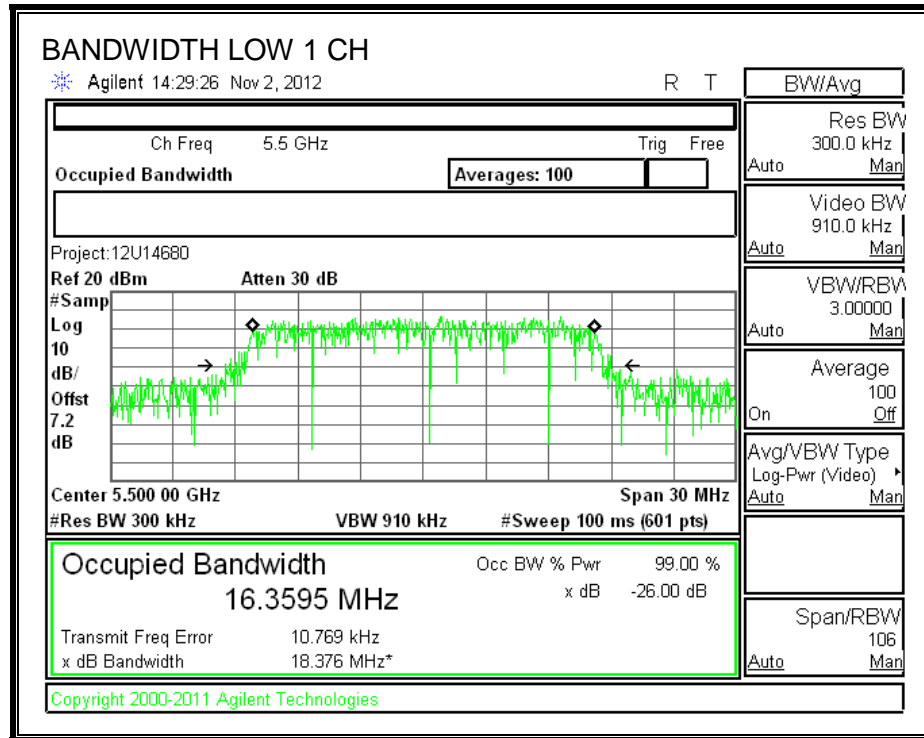
LIMITS

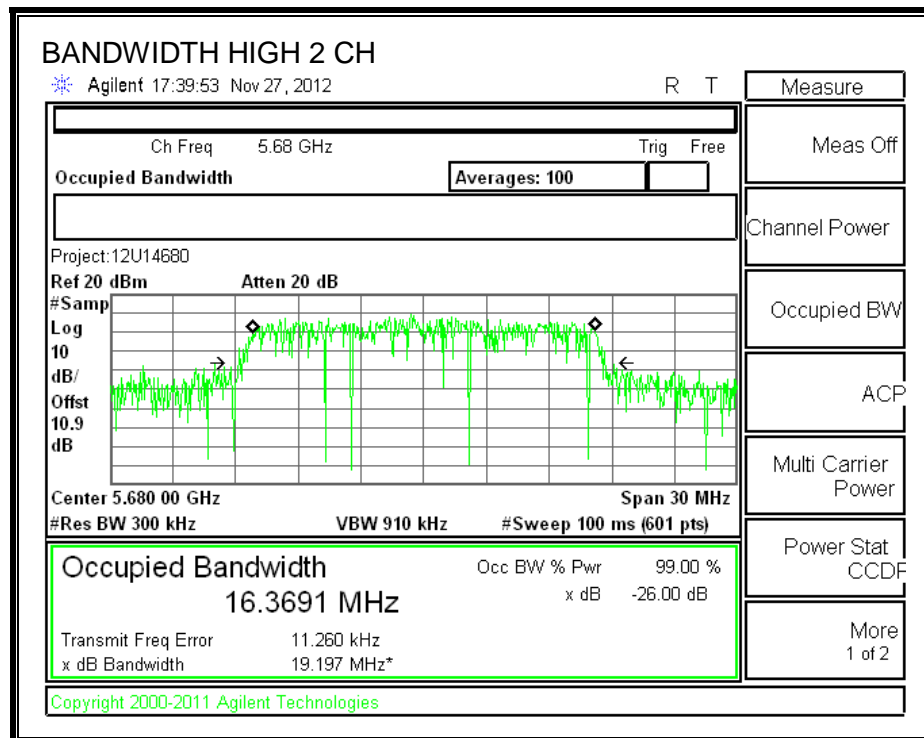
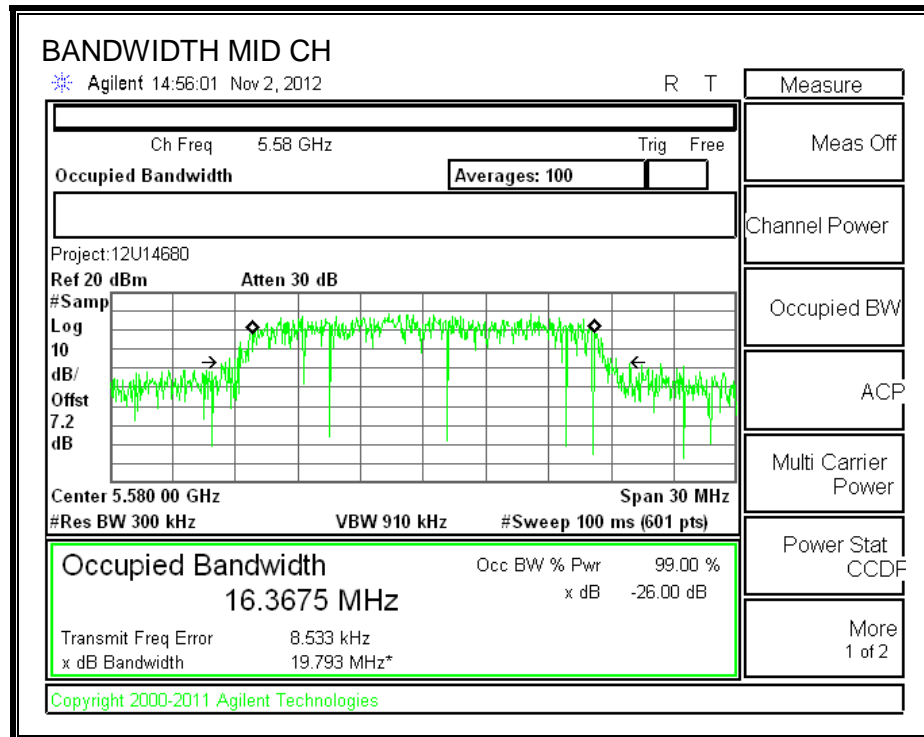
None; for reporting purposes only.

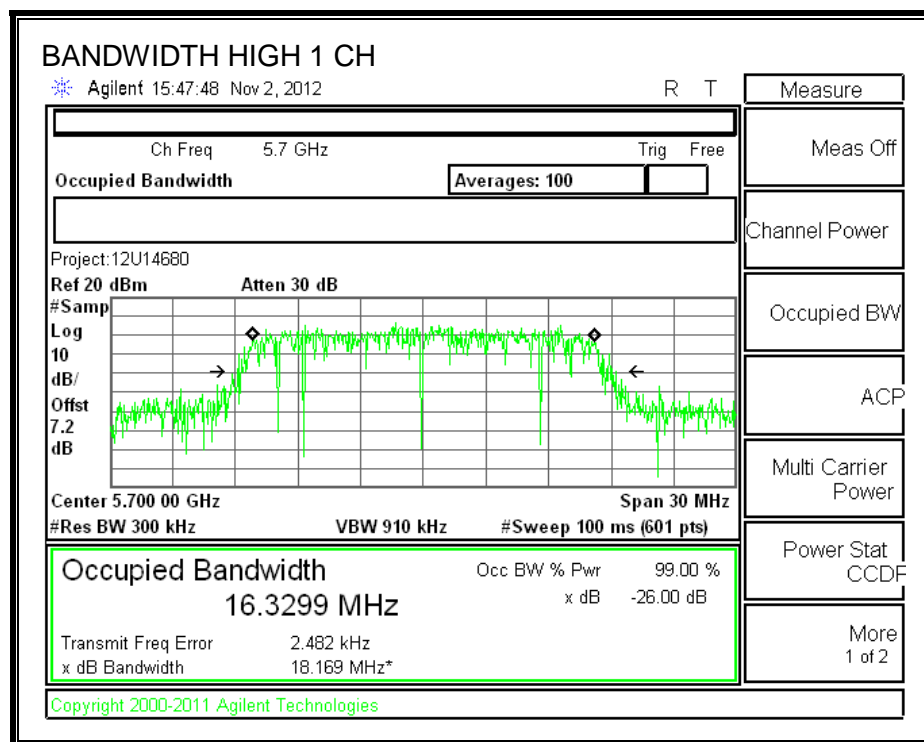
RESULTS

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|--------------------|------------------------|
| Low 1 | 5500 | 16.3595 |
| Low 2 | 5520 | 16.3751 |
| Mid | 5580 | 16.3675 |
| High 2 | 5680 | 16.3691 |
| High 1 | 5700 | 16.3299 |

99% BANDWIDTH







8.7.3. 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 10.9 dB (including 10 dB pad and 0.9 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

| Channel | Frequency (MHz) | Power (dBm) |
|---------|--------------------|----------------|
| Low | 5500 | 18.0 |
| Low 1 | 5520 | 19.5 |
| Mid | 5580 | 19.5 |
| High 2 | 5680 | 19.5 |
| High 1 | 5700 | 16.0 |

8.7.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (2)

For the band 5.47–5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. In addition, the maximum 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 maximum conducted output 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.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Bandwidth and Antenna Gain

| Channel | Frequency (MHz) | Min 26 dB BW (MHz) | Directional Gain (dBi) |
|---------|--------------------|-----------------------------|------------------------------|
| Low 1 | 5500 | 21.67 | 2.62 |
| Low 2 | 5520 | 27.87 | 2.62 |
| Mid | 5580 | 27.33 | 2.62 |
| High 2 | 5680 | 26.80 | 2.62 |
| High 1 | 5700 | 19.13 | 2.62 |

Limits

| Channel | Frequency (MHz) | FCC Power Limit (dBm) | FCC PPSD Limit (dBm) |
|---------|--------------------|--------------------------------|-------------------------------|
| Low 1 | 5500 | 24.00 | 11.00 |
| Low 2 | 5520 | 24.00 | 11.00 |
| Mid | 5580 | 24.00 | 11.00 |
| High 2 | 5680 | 24.00 | 11.00 |
| High 1 | 5700 | 23.82 | 11.00 |

| | | |
|--------------------|------|--|
| Duty Cycle CF (dB) | 0.00 | Included in Calculations of Corr'd Power & PSD |
|--------------------|------|--|

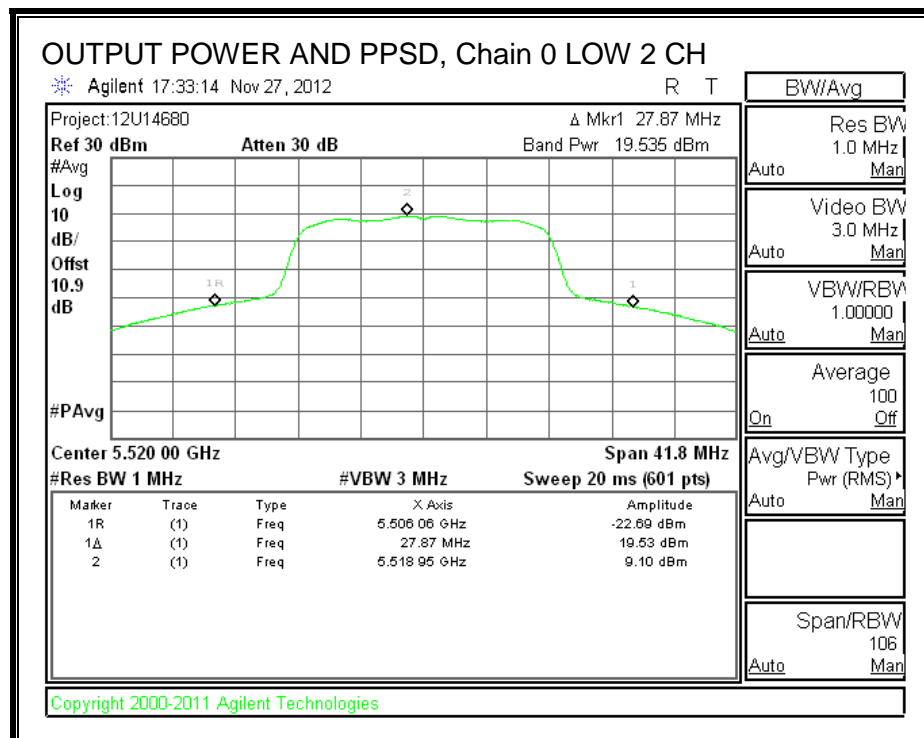
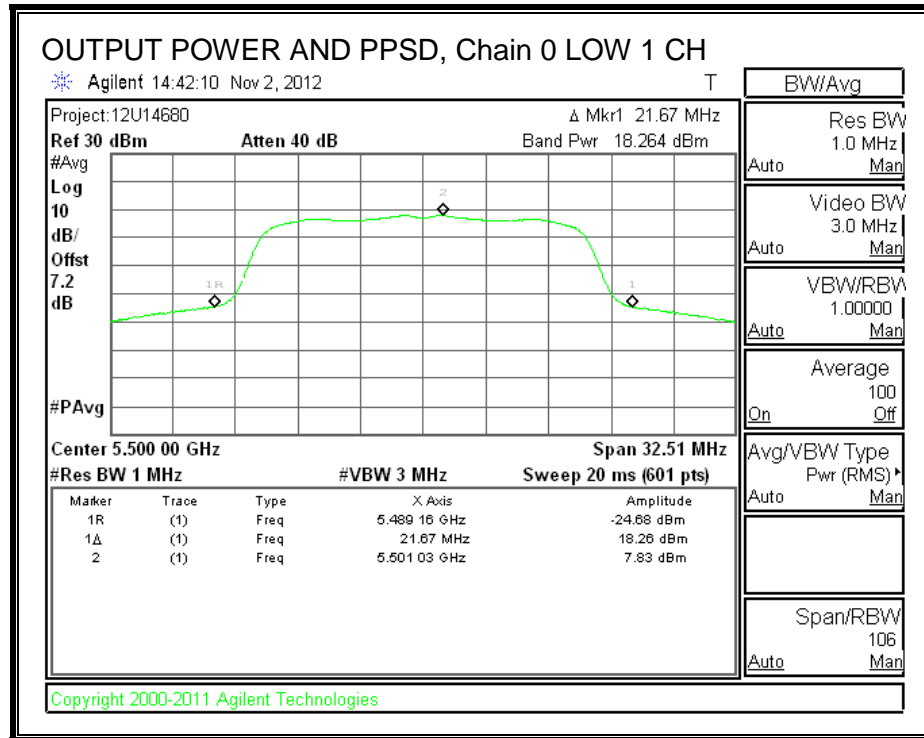
Output Power Results

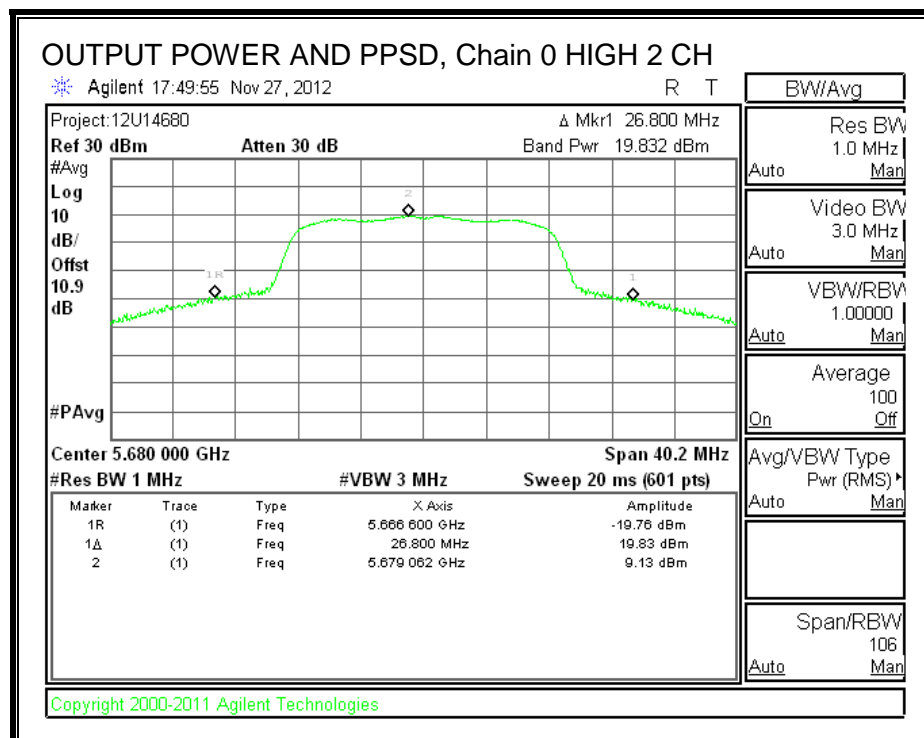
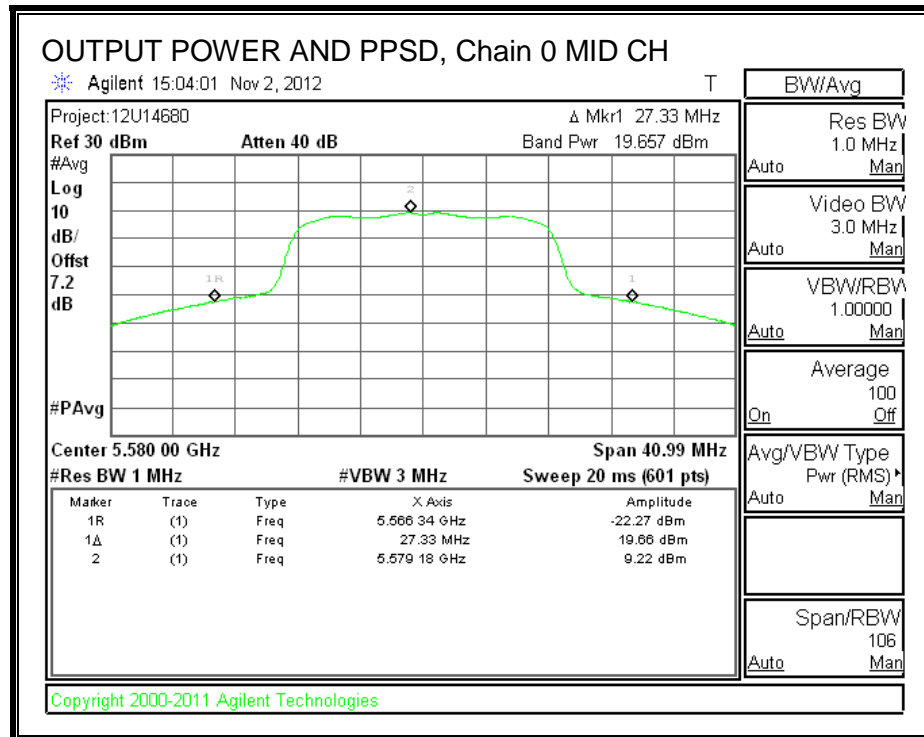
| Channel | Frequency (MHz) | Chain 0 Meas Power (dBm) | Total Corr'd Power (dBm) | Power Limit (dBm) | Power Margin (dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-------------------------|-------------------------|
| Low 1 | 5500 | 18.26 | 18.26 | 24.00 | -5.74 |
| Low 2 | 5520 | 19.54 | 19.54 | 24.00 | -4.47 |
| Mid | 5580 | 19.66 | 19.66 | 24.00 | -4.34 |
| High 2 | 5680 | 19.83 | 19.83 | 24.00 | -4.17 |
| High 1 | 5700 | 16.21 | 16.21 | 23.82 | -7.61 |

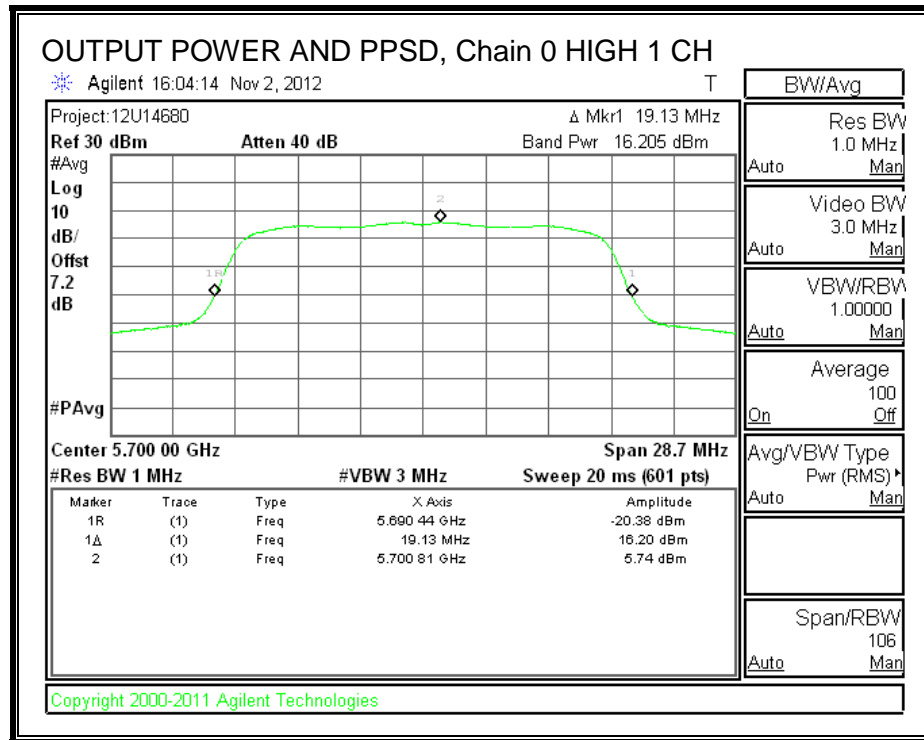
PPSD Results

| Channel | Frequency (MHz) | Chain 0 Meas PPSD (dBm) | Total Corr'd PPSD (dBm) | PPSD Limit (dBm) | PPSD Margin (dB) |
|---------|--------------------|----------------------------------|----------------------------------|------------------------|------------------------|
| Low 1 | 5500 | 7.83 | 7.83 | 11.00 | -3.17 |
| Low 2 | 5520 | 9.10 | 9.10 | 11.00 | -1.90 |
| Mid | 5580 | 9.22 | 9.22 | 11.00 | -1.78 |
| High 2 | 5680 | 9.13 | 9.13 | 11.00 | -1.87 |
| High 1 | 5700 | 5.74 | 5.74 | 11.00 | -5.26 |

OUTPUT POWER AND PPSD, Chain 0







8.7.5. TPC POWER

LIMITS

FCC §15.407 (h) (1)

Transmit power control (TPC). U-NII devices operating in the 5.25–5.35 GHz band and the 5.47–5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

EIRP is less than 27 dBm; therefore, TPC is not required.

8.8. 802.11n HT20 MODE IN THE 5.6 GHz BAND

8.8.1. 26 dB BANDWIDTH

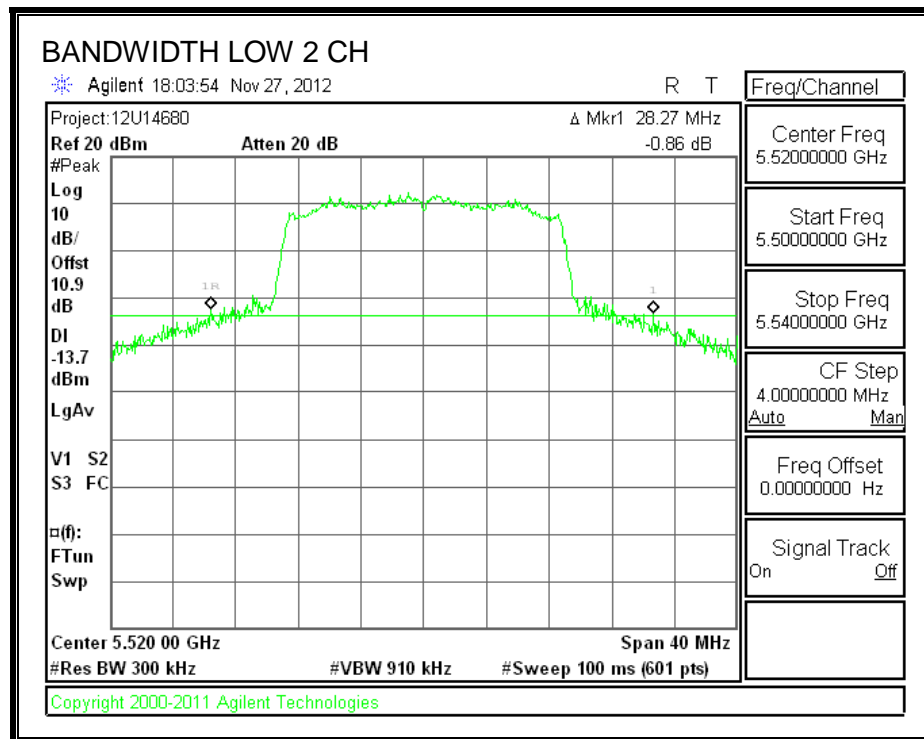
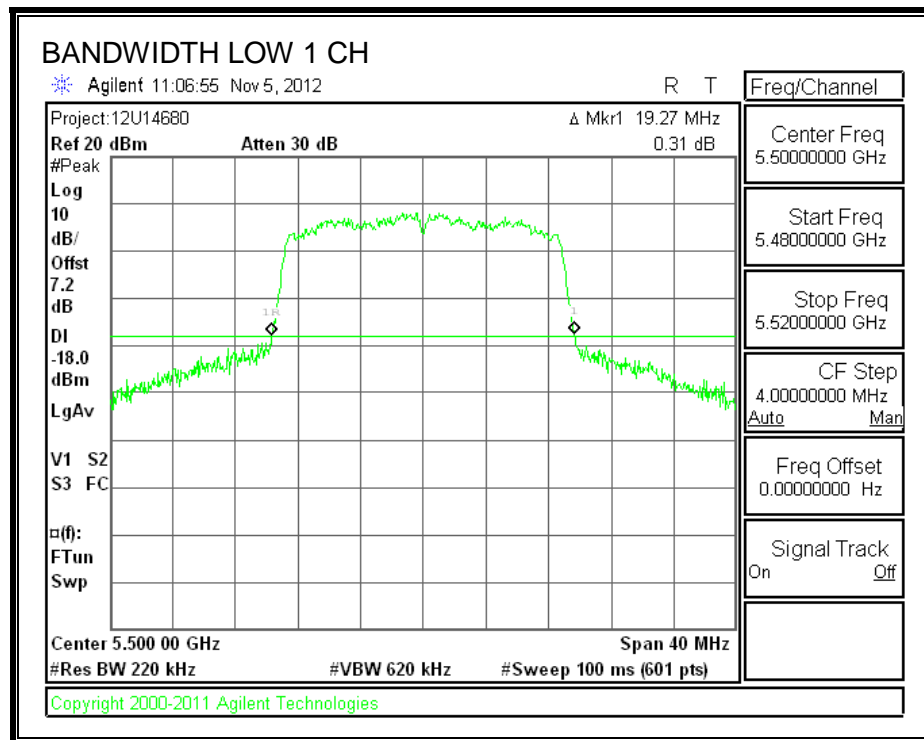
LIMITS

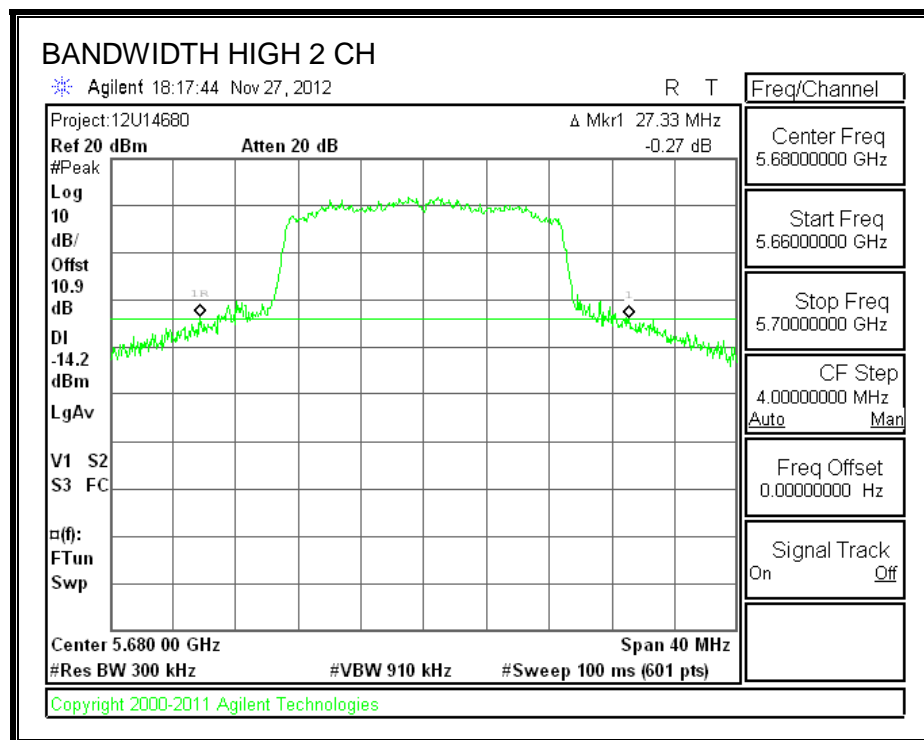
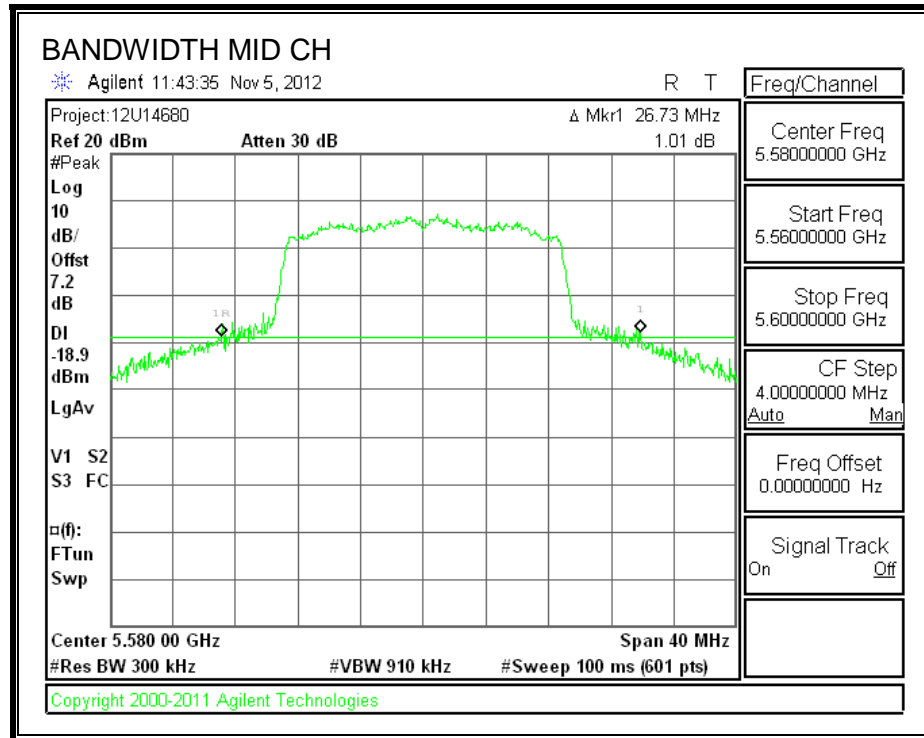
None; for reporting purposes only.

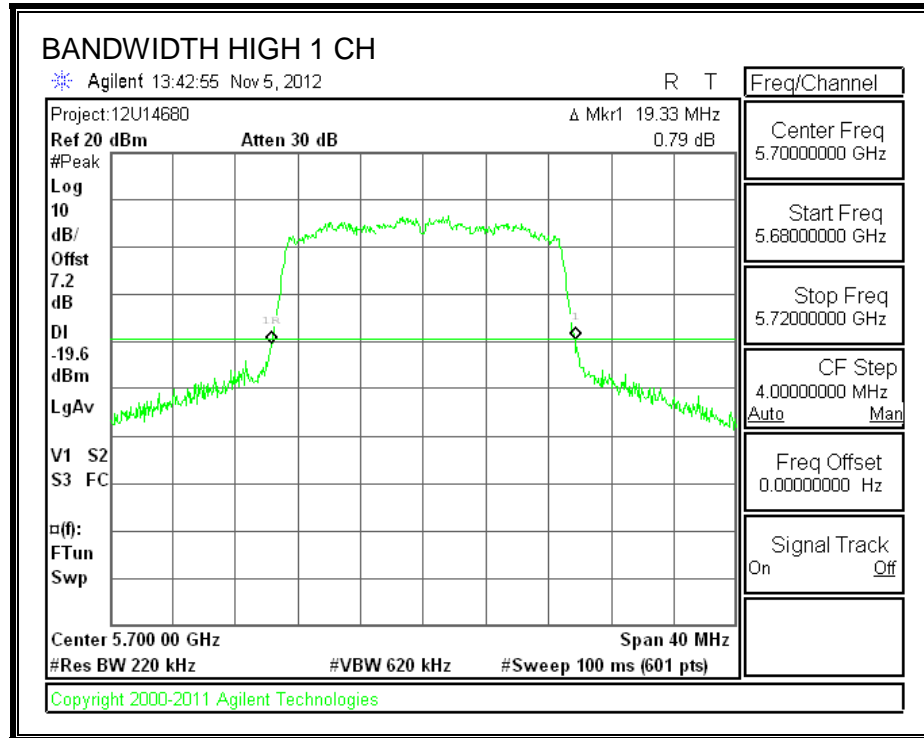
RESULTS

| Channel | Frequency (MHz) | 26 dB Bandwidth (MHz) |
|---------|--------------------|--------------------------|
| Low 1 | 5500 | 19.27 |
| Low 2 | 5520 | 28.27 |
| Mid | 5580 | 26.73 |
| High 2 | 5680 | 27.33 |
| High 1 | 5700 | 19.33 |

26 dB BANDWIDTH







8.8.2. 99% BANDWIDTH

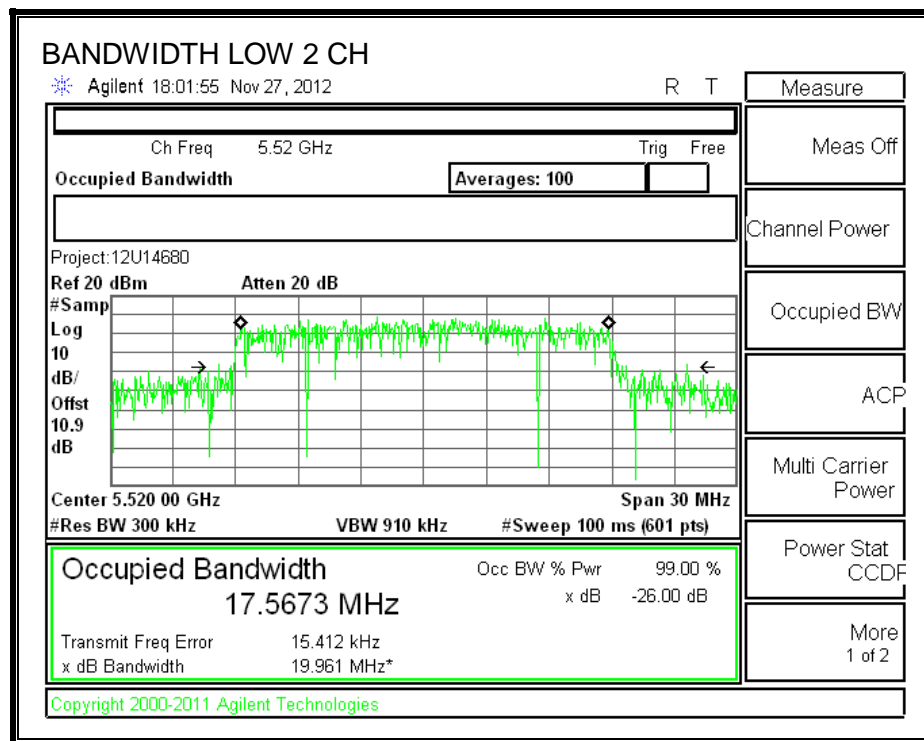
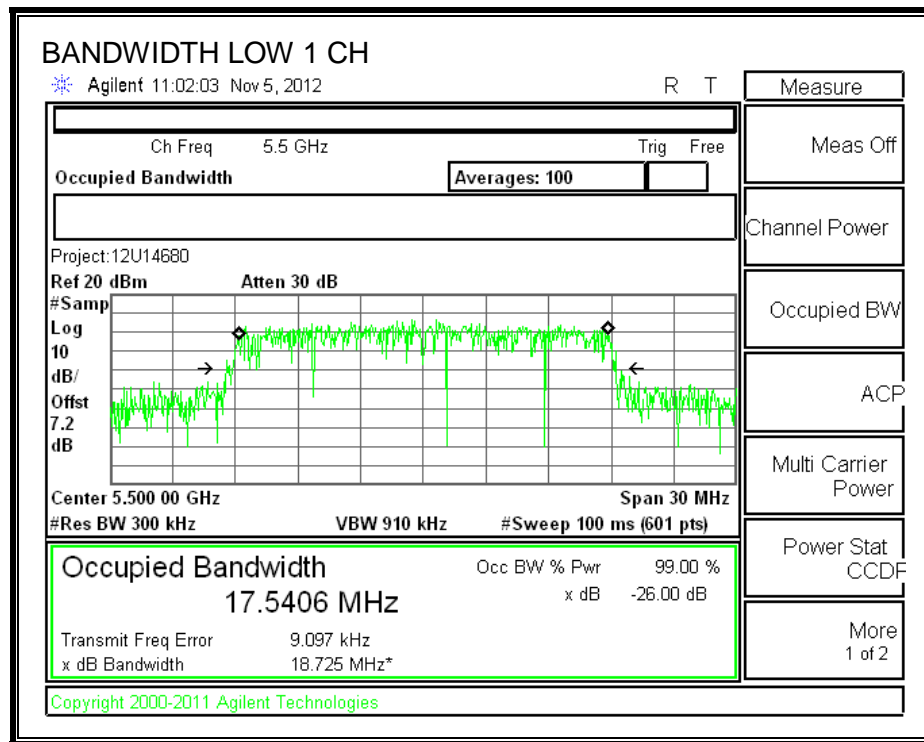
LIMITS

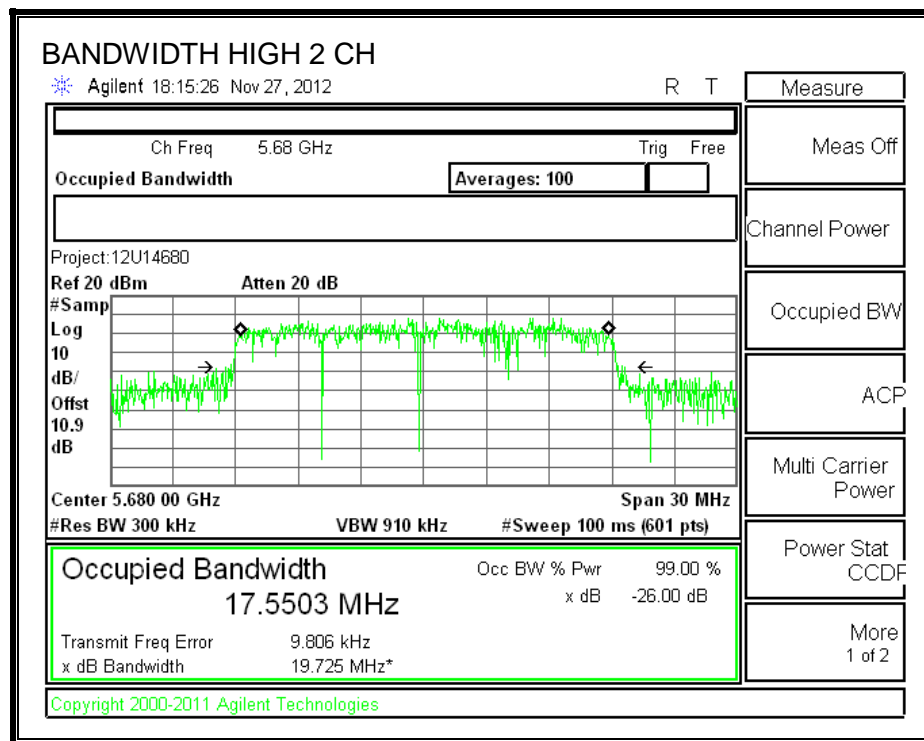
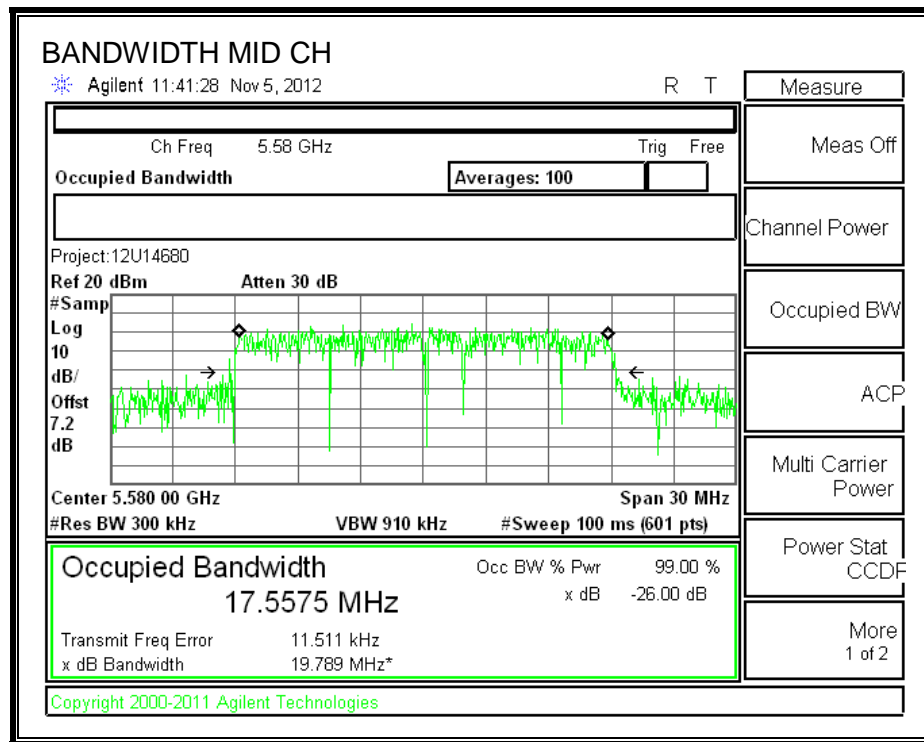
None; for reporting purposes only.

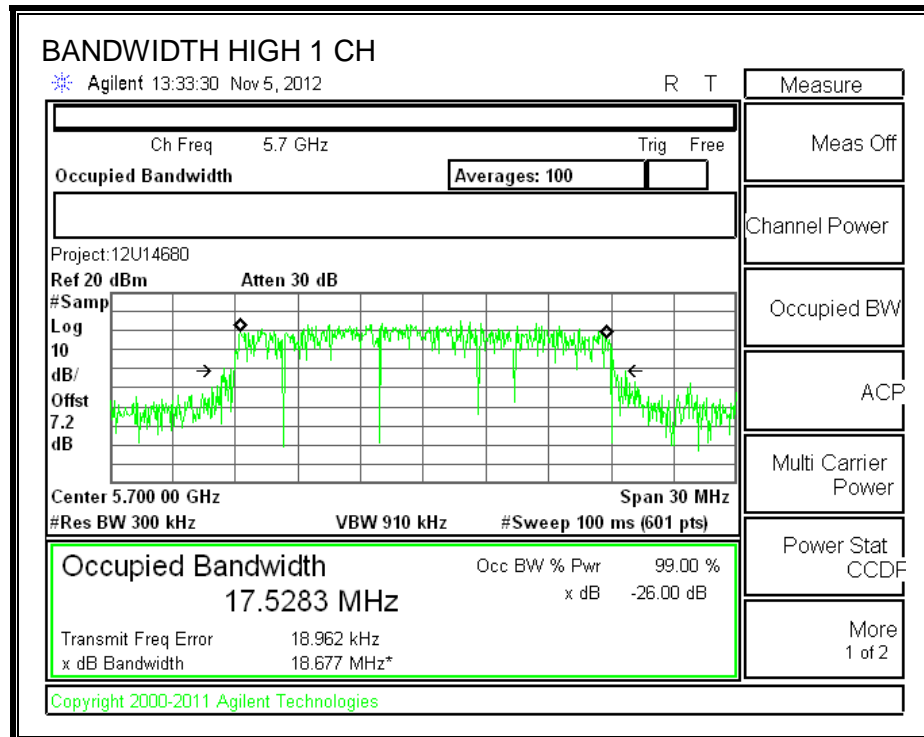
RESULTS

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|--------------------|------------------------|
| Low 1 | 5500 | 17.5406 |
| Low 2 | 5520 | 17.5673 |
| Mid | 5580 | 17.5575 |
| High 2 | 5680 | 17.5503 |
| High 1 | 5700 | 17.5283 |

99% BANDWIDTH







8.8.3. 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 10.9 dB (including 10 dB pad and 0.9 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

| Channel | Frequency (MHz) | Power (dBm) |
|---------|--------------------|----------------|
| Low 1 | 5500 | 17.0 |
| Low 2 | 5520 | 19.5 |
| Mid | 5580 | 19.5 |
| High 2 | 5680 | 19.5 |
| High 1 | 5700 | 15.5 |

8.8.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (2)

For the band 5.47–5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. In addition, the maximum 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 maximum conducted output 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.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Bandwidth and Antenna Gain

| Channel | Frequency (MHz) | Min 26 dB BW (MHz) | Directional Gain (dBi) |
|---------|--------------------|-----------------------------|------------------------------|
| Low 1 | 5500 | 19.27 | 2.62 |
| Low 2 | 5520 | 28.27 | 2.62 |
| Mid | 5580 | 26.73 | 2.62 |
| High 2 | 5680 | 27.33 | 2.62 |
| High 1 | 5700 | 19.33 | 2.62 |

Limits

| Channel | Frequency (MHz) | FCC Power Limit (dBm) | FCC PPSD Limit (dBm) |
|---------|--------------------|--------------------------------|-------------------------------|
| Low 1 | 5500 | 23.85 | 11.00 |
| Low 2 | 5520 | 24.00 | 11.00 |
| Mid | 5580 | 24.00 | 11.00 |
| High 2 | 5680 | 24.00 | 11.00 |
| High 1 | 5700 | 23.86 | 11.00 |

| | | |
|--------------------|------|---|
| Duty Cycle CF (dB) | 0.00 | Included in Calculations of Corr'd Power & PPSP |
|--------------------|------|---|

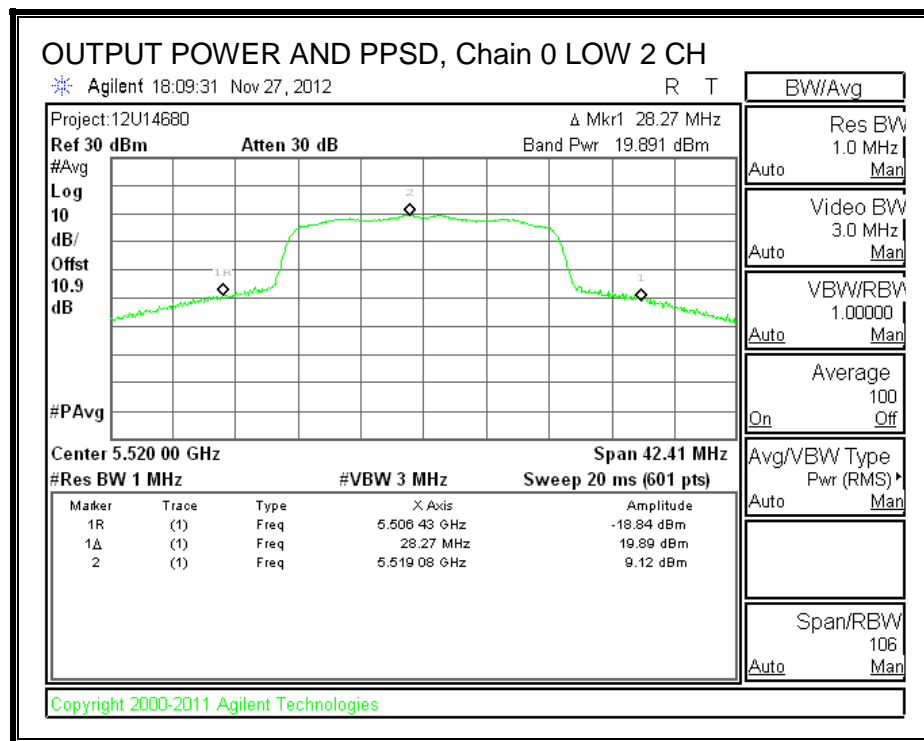
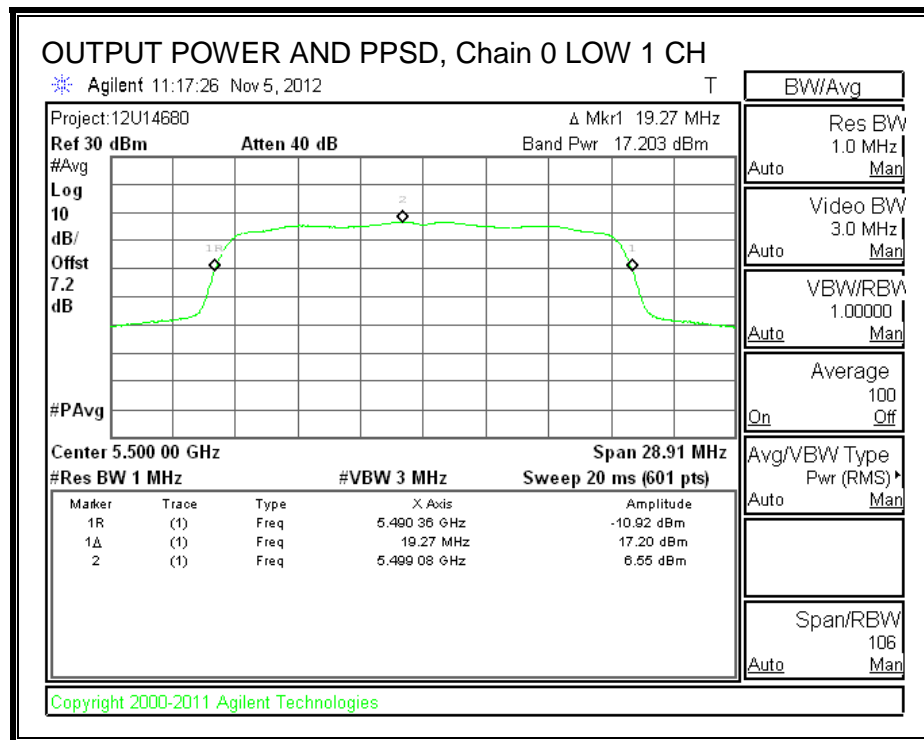
Output Power Results

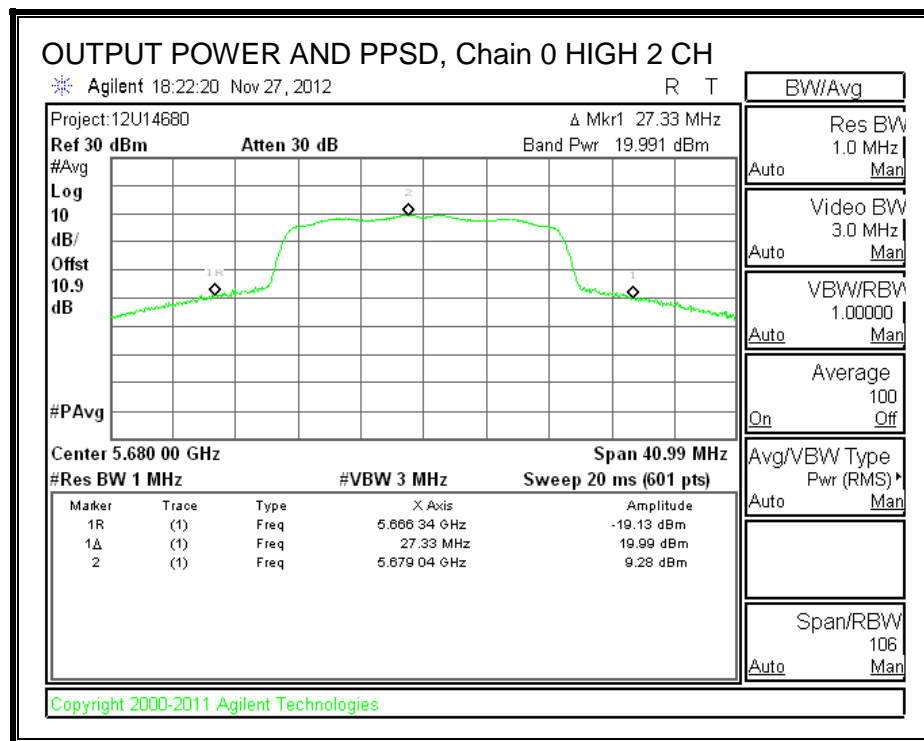
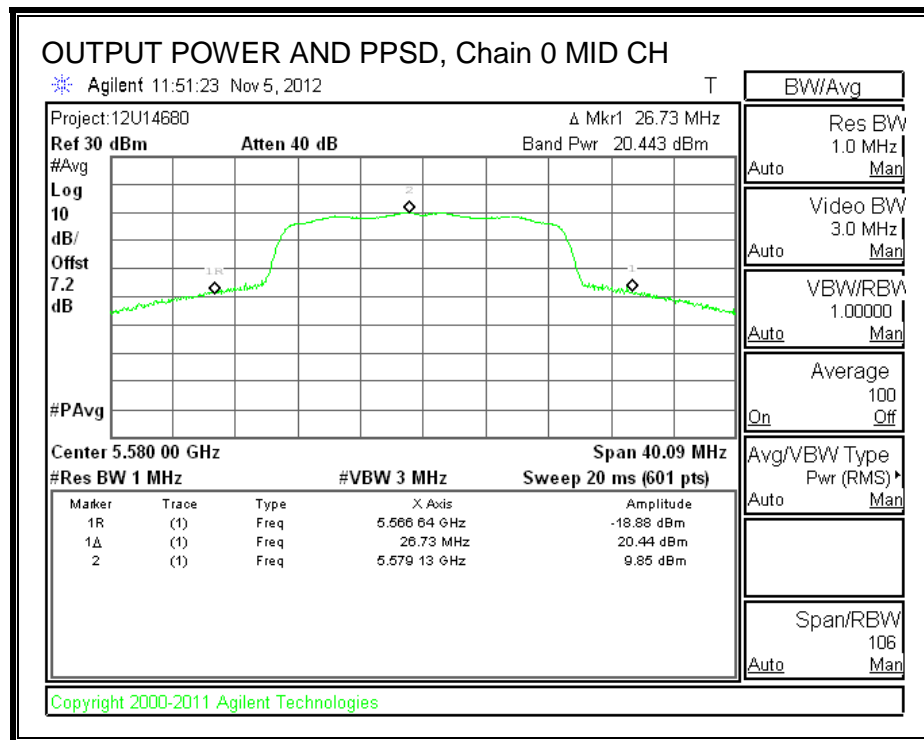
| Channel | Frequency (MHz) | Chain 0 Meas Power (dBm) | Total Corr'd Power (dBm) | Power Limit (dBm) | Power Margin (dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-------------------------|-------------------------|
| Low 1 | 5500 | 17.20 | 17.20 | 23.85 | -6.65 |
| Low 2 | 5520 | 19.89 | 19.89 | 24.00 | -4.11 |
| Mid | 5580 | 20.44 | 20.44 | 24.00 | -3.56 |
| High 2 | 5680 | 19.99 | 19.99 | 24.00 | -4.01 |
| High 1 | 5700 | 15.54 | 15.54 | 23.86 | -8.32 |

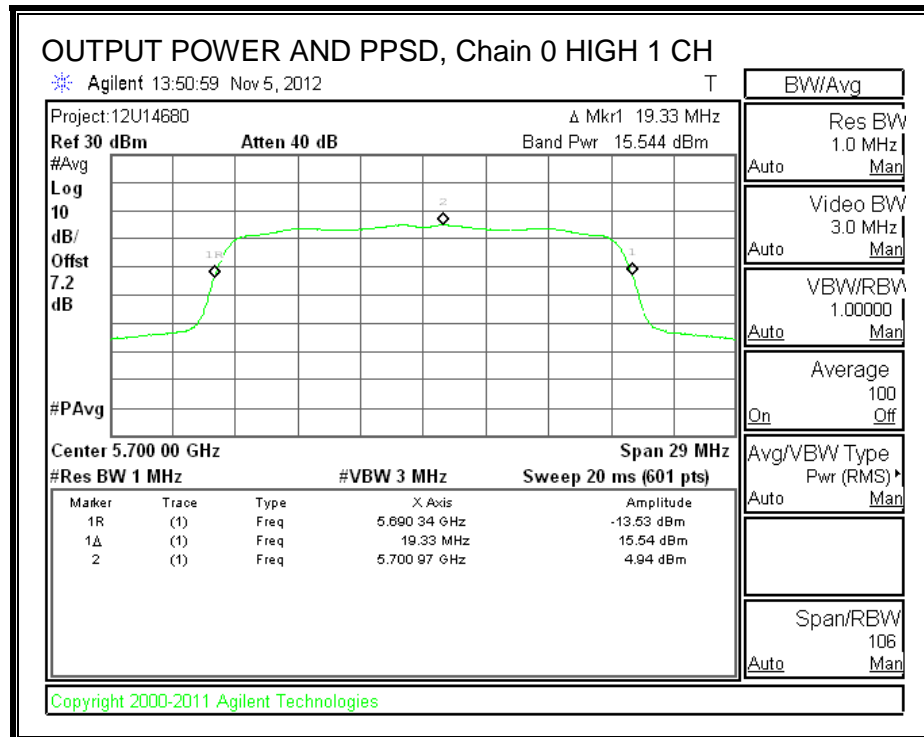
PPSD Results

| Channel | Frequency (MHz) | Chain 0 Meas PPSD (dBm) | Total Corr'd PPSD (dBm) | PPSD Limit (dBm) | PPSD Margin (dB) |
|---------|--------------------|----------------------------------|----------------------------------|------------------------|------------------------|
| Low 1 | 5500 | 6.55 | 6.55 | 11.00 | -4.45 |
| Low 2 | 5520 | 9.12 | 9.12 | 11.00 | -1.88 |
| Mid | 5580 | 9.85 | 9.85 | 11.00 | -1.15 |
| High 2 | 5680 | 9.28 | 9.28 | 11.00 | -1.72 |
| High 1 | 5700 | 4.94 | 4.94 | 11.00 | -6.06 |

OUTPUT POWER AND PPSD, Chain 0







8.8.5. TPC POWER

LIMITS

FCC §15.407 (h) (1)

Transmit power control (TPC). U-NII devices operating in the 5.25–5.35 GHz band and the 5.47–5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

EIRP is less than 27 dBm; therefore, TPC is not required.

8.9. 802.11n HT40 MODE IN THE 5.6 GHz BAND

8.9.1. 26 dB BANDWIDTH

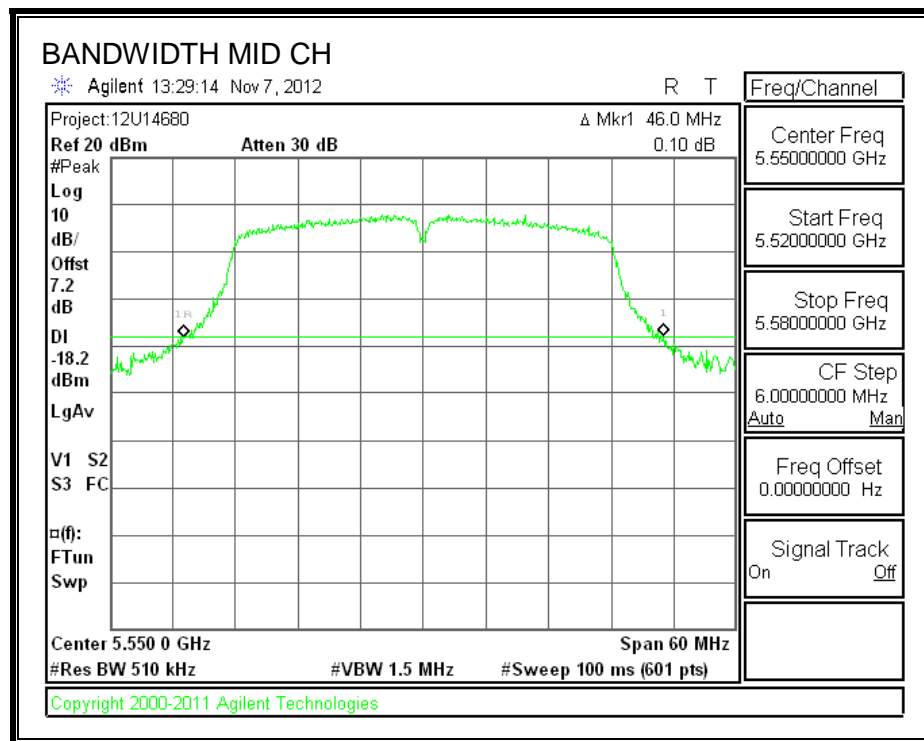
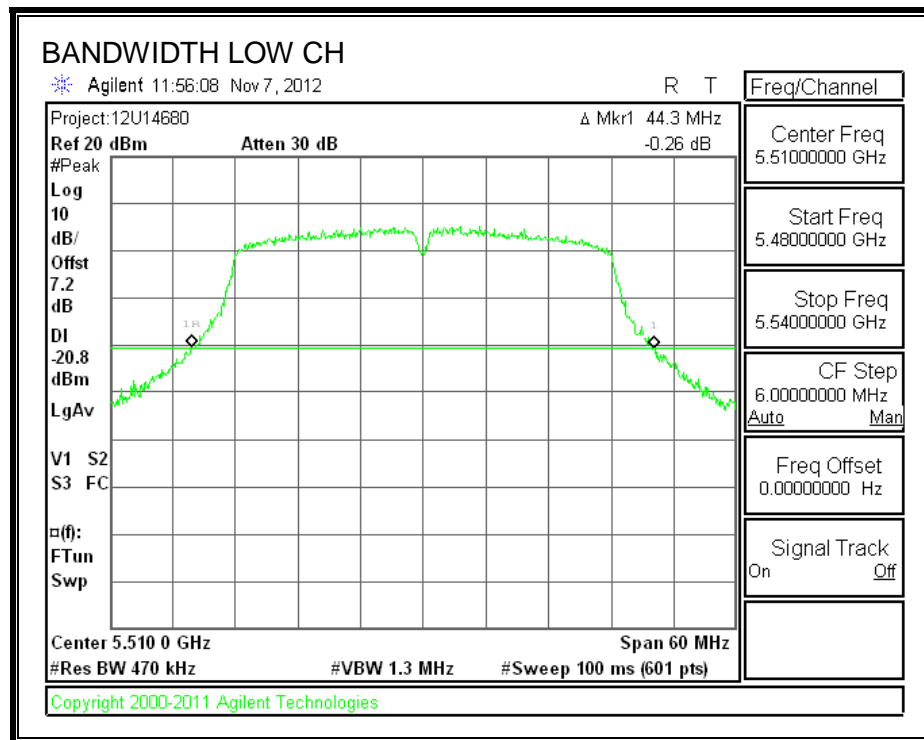
LIMITS

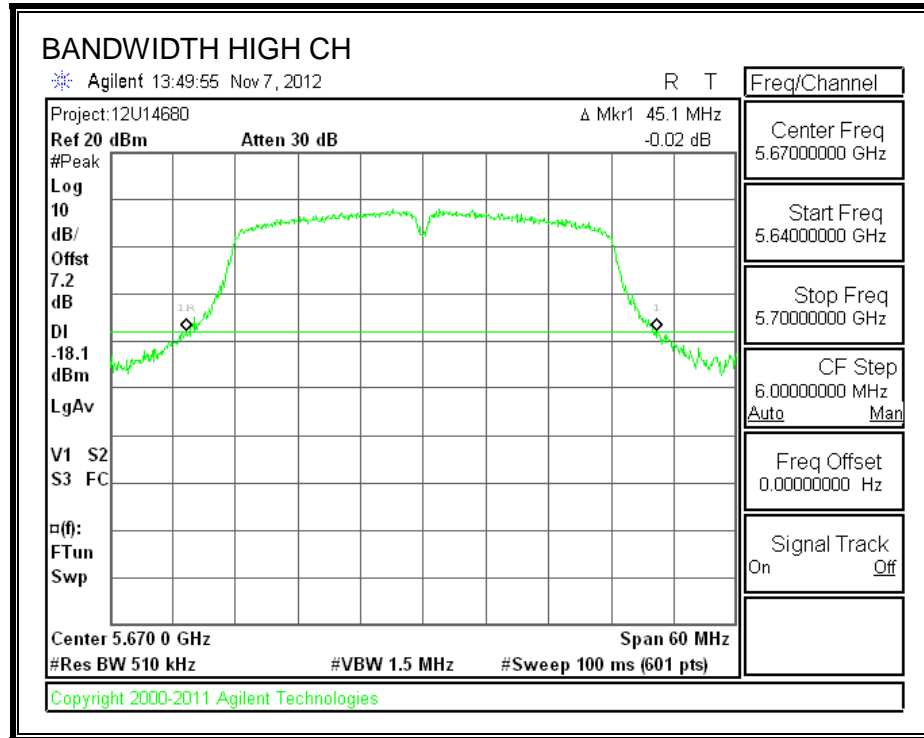
None; for reporting purposes only.

RESULTS

| Channel | Frequency (MHz) | 26 dB Bandwidth (MHz) |
|---------|--------------------|--------------------------|
| Low | 5510 | 44.3 |
| Mid | 5550 | 46.0 |
| High | 5670 | 45.1 |

26 dB BANDWIDTH





8.9.2. 99% BANDWIDTH

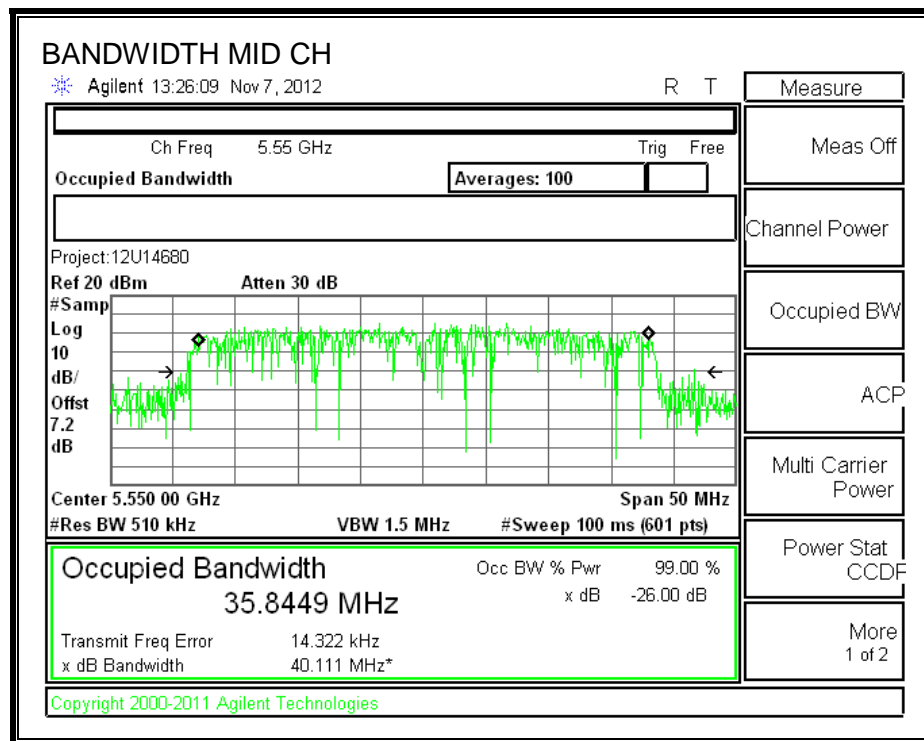
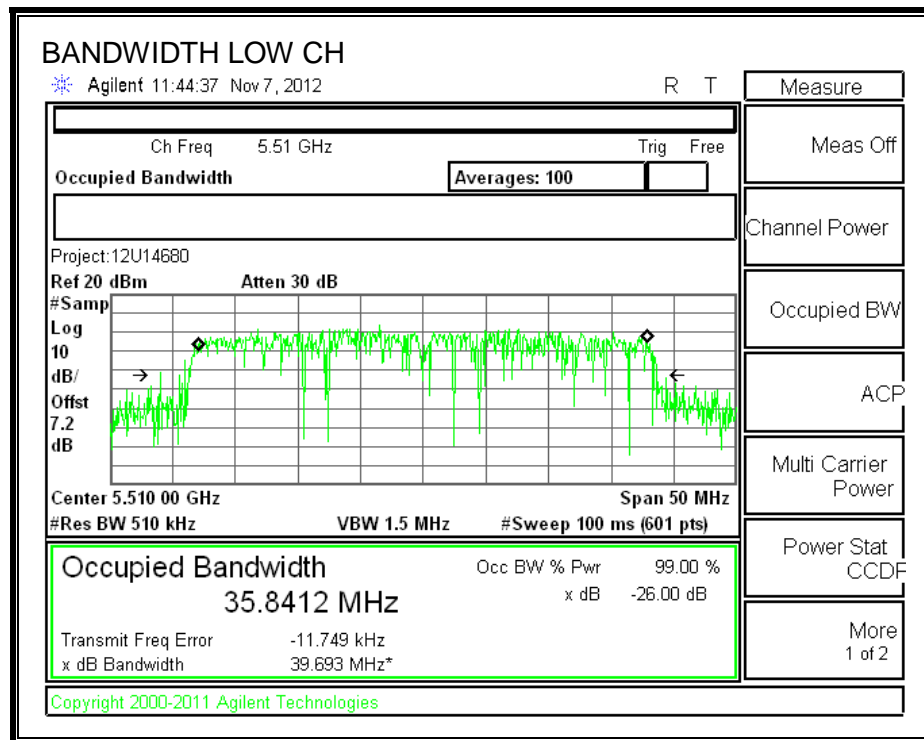
LIMITS

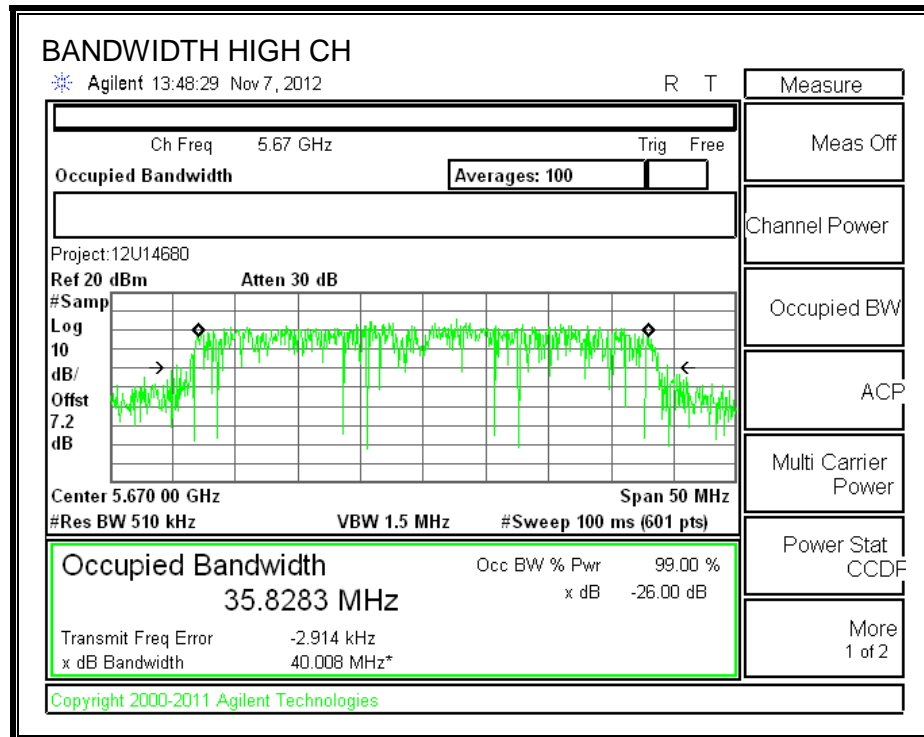
None; for reporting purposes only.

RESULTS

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|--------------------|------------------------|
| Low | 5510 | 35.8412 |
| Mid | 5550 | 35.8449 |
| High | 5670 | 35.8283 |

99% BANDWIDTH





8.9.3. 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 10.9 dB (including 10 dB pad and 0.9 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

| Channel | Frequency (MHz) | Power (dBm) |
|---------|--------------------|----------------|
| Low | 5510 | 13.5 |
| Mid | 5550 | 16.0 |
| High | 5670 | 16.0 |

8.9.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (2)

For the band 5.47–5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. In addition, the maximum 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 maximum conducted output 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.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Bandwidth and Antenna Gain

| Channel | Frequency (MHz) | Min 26 dB BW (MHz) | Directional Gain (dBi) |
|---------|--------------------|-----------------------------|------------------------------|
| Low | 5510 | 44.3 | 2.34 |
| Mid | 5550 | 46.0 | 2.34 |
| High | 5670 | 45.1 | 2.34 |

Limits

| Channel | Frequency (MHz) | FCC Power Limit (dBm) | FCC PPSD Limit (dBm) |
|---------|--------------------|--------------------------------|-------------------------------|
| Low | 5510 | 24.00 | 11.00 |
| Mid | 5550 | 24.00 | 11.00 |
| High | 5670 | 24.00 | 11.00 |

| | | |
|--------------------|------|---|
| Duty Cycle CF (dB) | 0.00 | Included in Calculations of Corr'd Power & PPSP |
|--------------------|------|---|

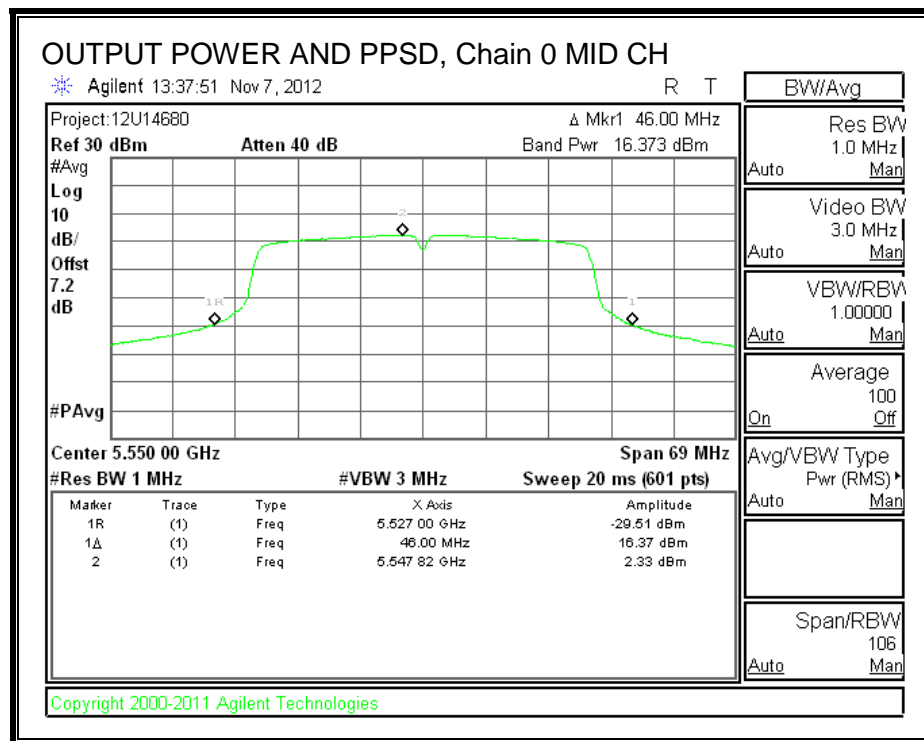
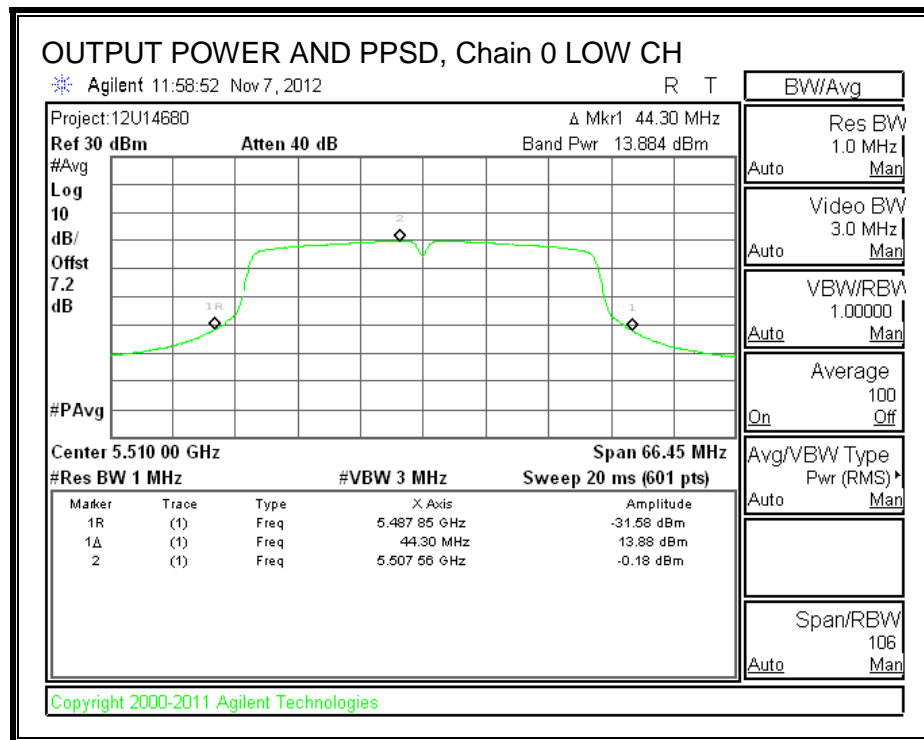
Output Power Results

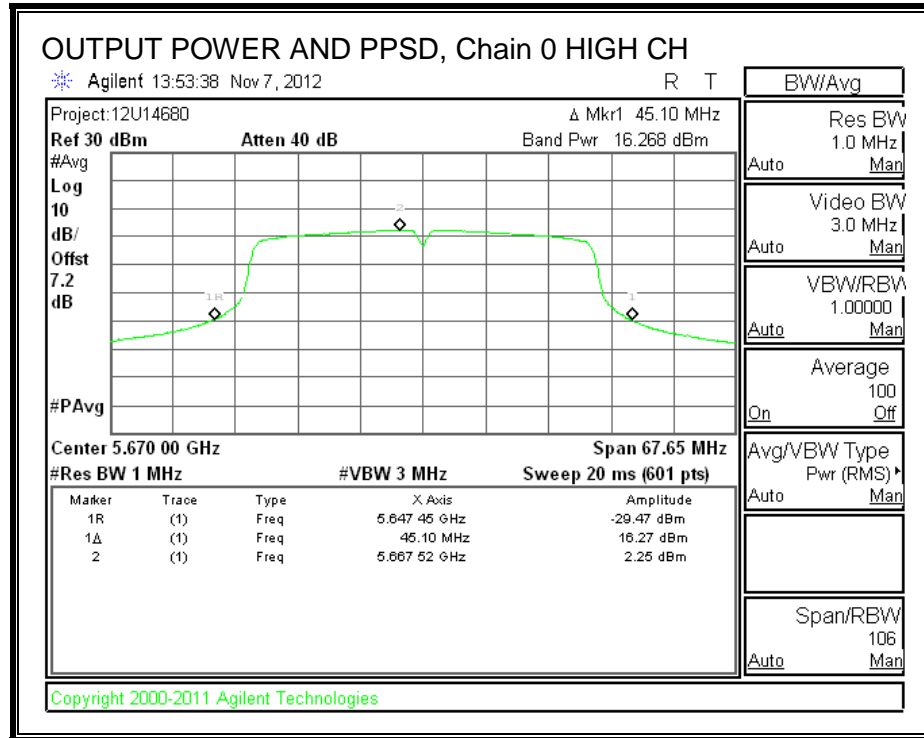
| Channel | Frequency (MHz) | Chain 0 Meas Power (dBm) | Total Corr'd Power (dBm) | Power Limit (dBm) | Power Margin (dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-------------------------|-------------------------|
| Low | 5510 | 13.88 | 13.88 | 24.00 | -10.12 |
| Mid | 5550 | 16.37 | 16.37 | 24.00 | -7.63 |
| High | 5670 | 16.27 | 16.27 | 24.00 | -7.73 |

PPSD Results

| Channel | Frequency (MHz) | Chain 0 Meas PPSD (dBm) | Total Corr'd PPSD (dBm) | PPSD Limit (dBm) | PPSD Margin (dB) |
|---------|--------------------|----------------------------------|----------------------------------|------------------------|------------------------|
| Low | 5510 | -0.18 | -0.18 | 11.00 | -11.18 |
| Mid | 5550 | 2.33 | 2.33 | 11.00 | -8.67 |
| High | 5670 | 2.25 | 2.25 | 11.00 | -8.75 |

OUTPUT POWER AND PPSD, Chain 0





8.9.5. TPC POWER

LIMITS

FCC §15.407 (h) (1)

Transmit power control (TPC). U-NII devices operating in the 5.25–5.35 GHz band and the 5.47–5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

EIRP is less than 27 dBm; therefore, TPC is not required.

9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

| 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.

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; the video bandwidth is set to 1 MHz for peak measurements and as applicable 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.

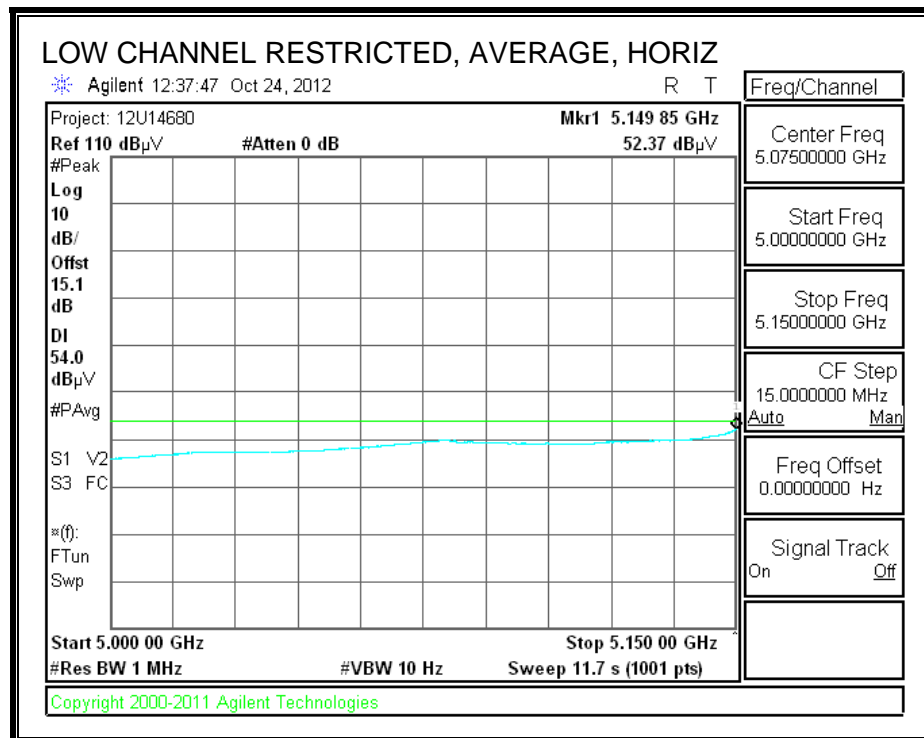
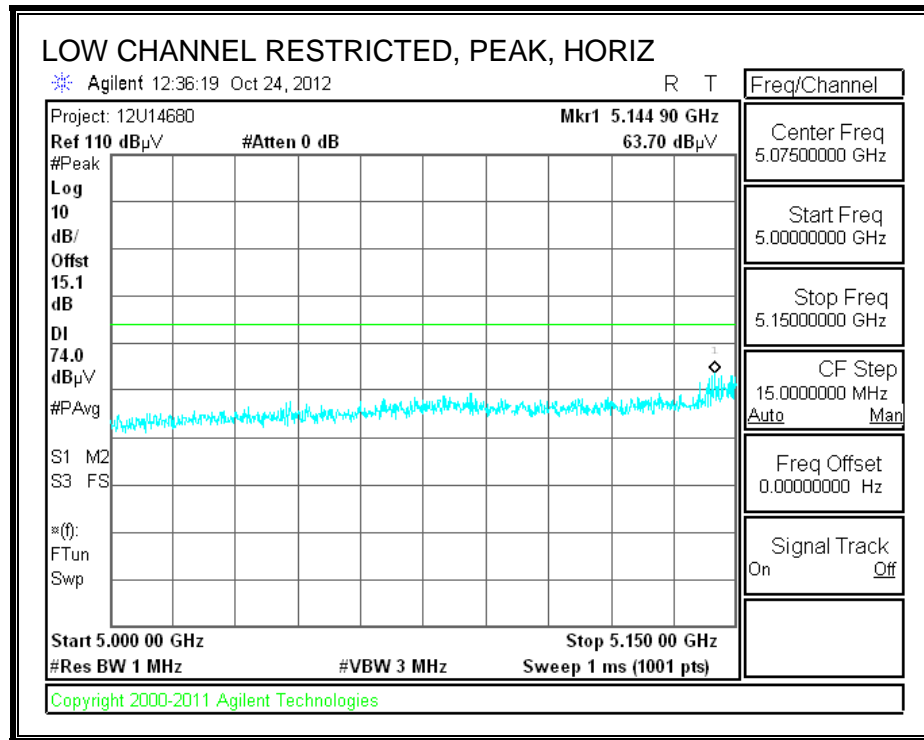
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

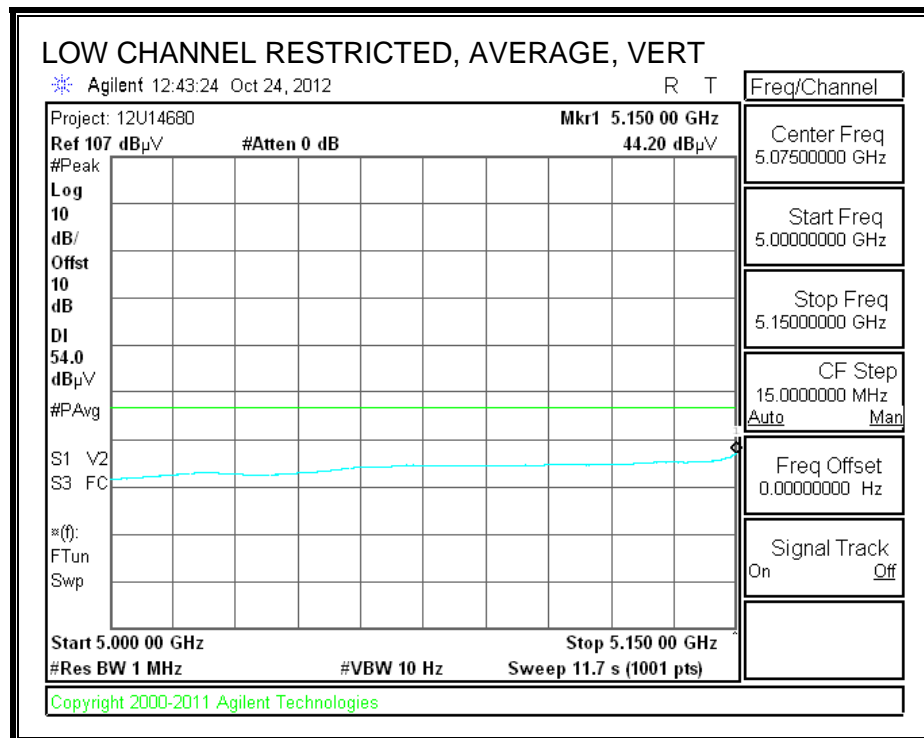
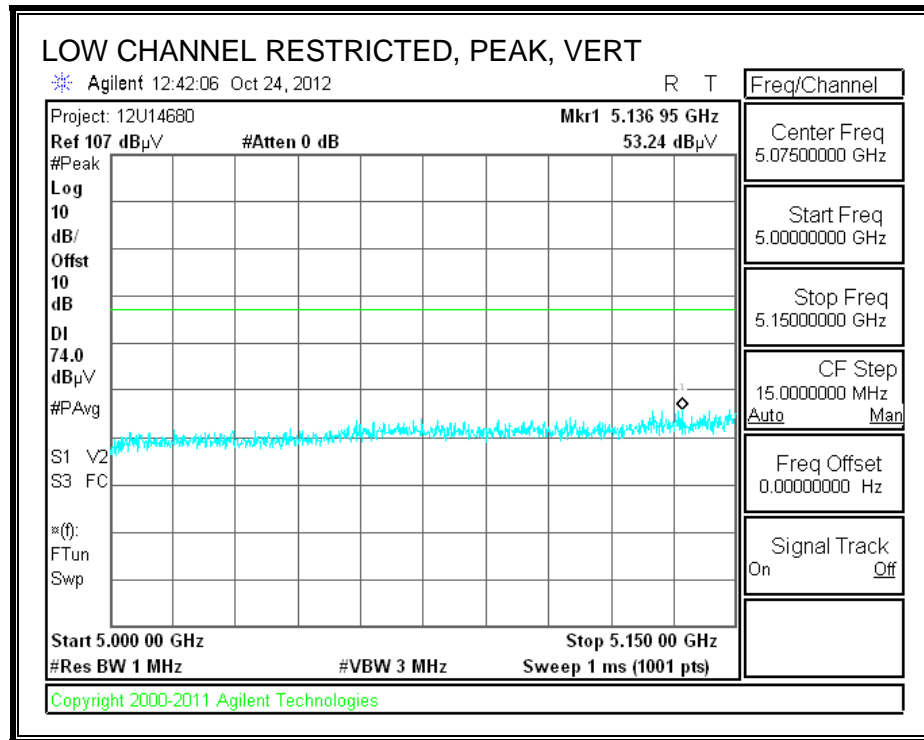
TEST RESULT

No other spurious emissions were found above 18G.

9.2. TX ABOVE 1 GHz 802.11a MODE IN THE 5.2 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement

Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 11/05/12
Project #: 12U14680
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11a TX 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

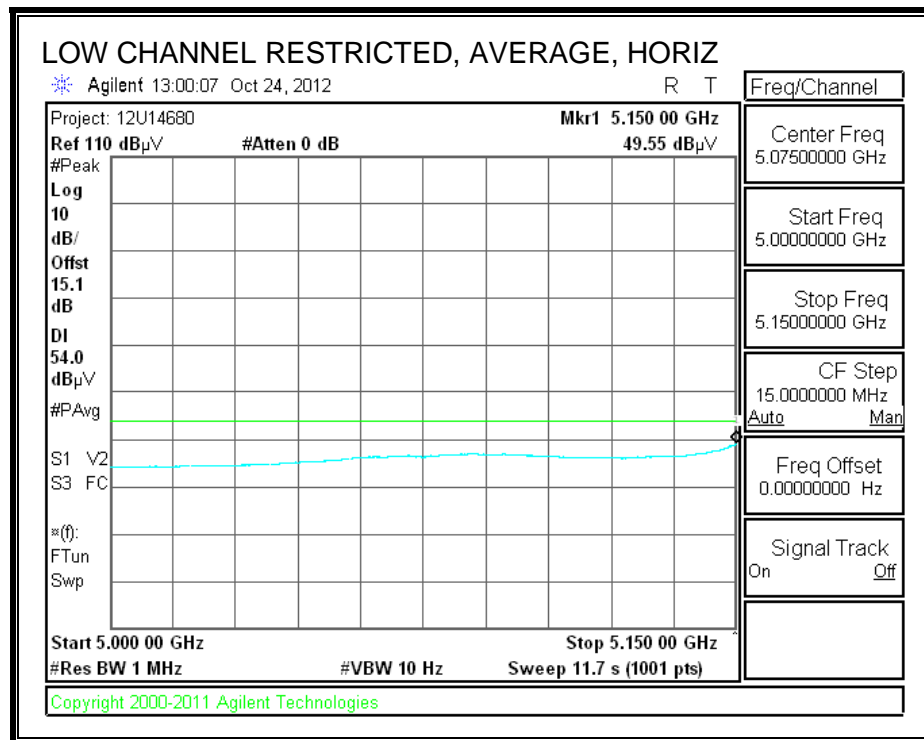
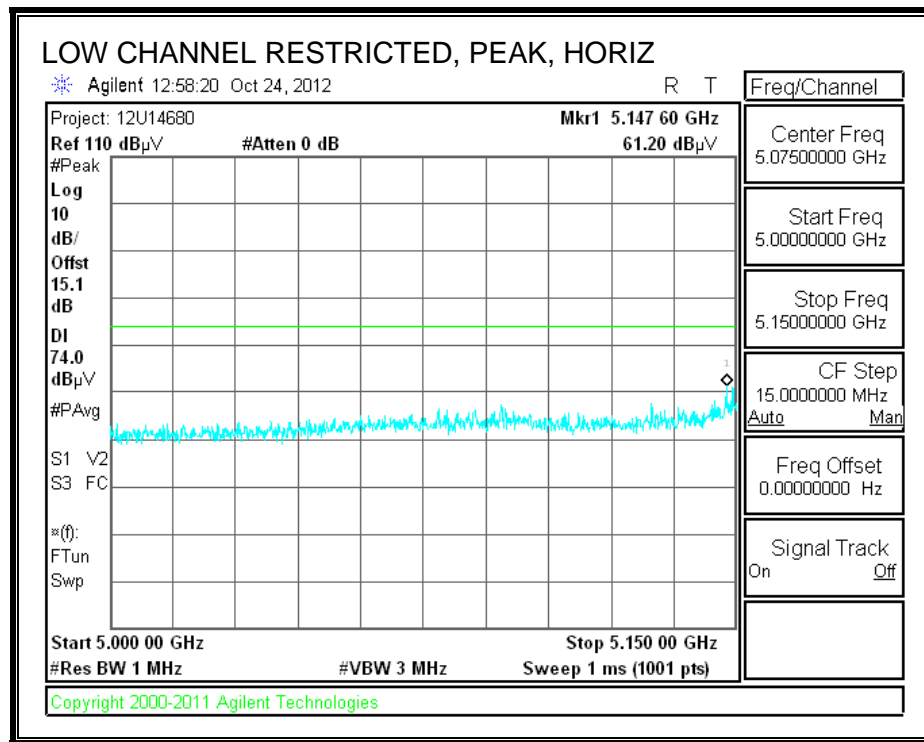
| f GHz | Dist (m) | Read dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Corr. dBuV/m | Limit dBuV/m | Margin dB | Ant. Pol. V/H | Det. P/A/Q/P | Notes |
|---------------------|-------------|--------------|------------|----------|-----------|--------------|------------|-----------------|-----------------|--------------|------------------|-----------------|-------|
| 5180 MHz 11a | | | | | | | | | | | | | |
| 15.540 | 3.0 | 36.2 | 39.1 | 13.0 | -31.9 | 0.0 | 0.7 | 57.0 | 74.0 | -17.0 | H | P | |
| 15.540 | 3.0 | 24.8 | 39.1 | 13.0 | -31.9 | 0.0 | 0.7 | 45.6 | 54.0 | -8.4 | H | A | |
| 15.540 | 3.0 | 35.1 | 39.1 | 13.0 | -31.9 | 0.0 | 0.7 | 55.9 | 74.0 | -18.1 | V | P | |
| 15.540 | 3.0 | 24.5 | 39.1 | 13.0 | -31.9 | 0.0 | 0.7 | 45.3 | 54.0 | -8.7 | V | A | |
| 5200 MHz 11a | | | | | | | | | | | | | |
| 15.600 | 3.0 | 34.3 | 38.8 | 13.0 | -31.9 | 0.0 | 0.7 | 54.9 | 74.0 | -19.1 | V | P | |
| 15.600 | 3.0 | 24.3 | 38.8 | 13.0 | -31.9 | 0.0 | 0.7 | 45.0 | 54.0 | -9.0 | V | A | |
| 15.600 | 3.0 | 35.4 | 38.8 | 13.0 | -31.9 | 0.0 | 0.7 | 56.0 | 74.0 | -18.0 | H | P | |
| 15.600 | 3.0 | 24.3 | 38.8 | 13.0 | -31.9 | 0.0 | 0.7 | 45.0 | 54.0 | -9.0 | H | A | |
| 5240 MHz 11a | | | | | | | | | | | | | |
| 15.720 | 3.0 | 34.2 | 38.4 | 13.1 | -31.9 | 0.0 | 0.7 | 54.5 | 74.0 | -19.5 | H | P | |
| 15.720 | 3.0 | 24.2 | 38.4 | 13.1 | -31.9 | 0.0 | 0.7 | 44.5 | 54.0 | -9.5 | H | A | |
| 15.720 | 3.0 | 34.2 | 38.4 | 13.1 | -31.9 | 0.0 | 0.7 | 54.5 | 74.0 | -19.5 | V | P | |
| 15.720 | 3.0 | 24.2 | 38.4 | 13.1 | -31.9 | 0.0 | 0.7 | 44.5 | 54.0 | -9.5 | V | A | |

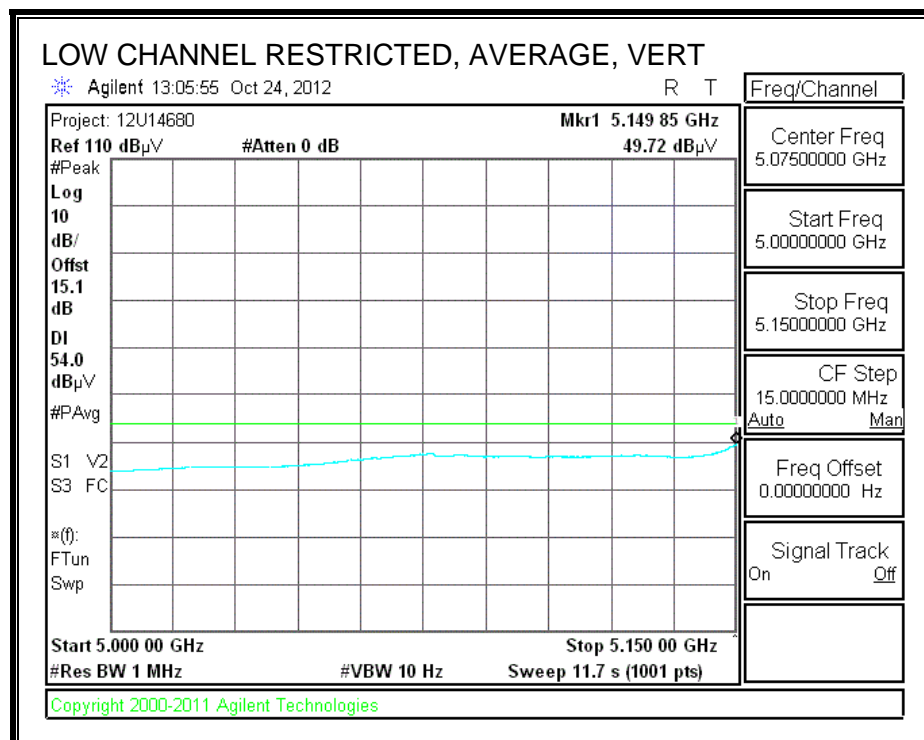
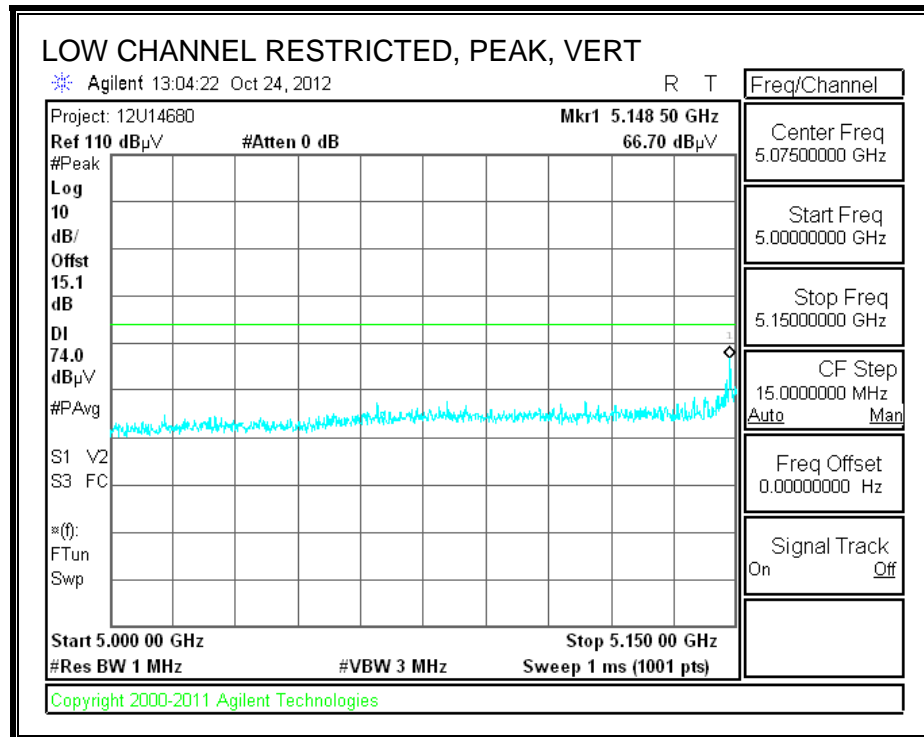
Rev. 4.1.2.7

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

9.3. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.2 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 11/05/12
Project #: 12U14680
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11n HT20 TX 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

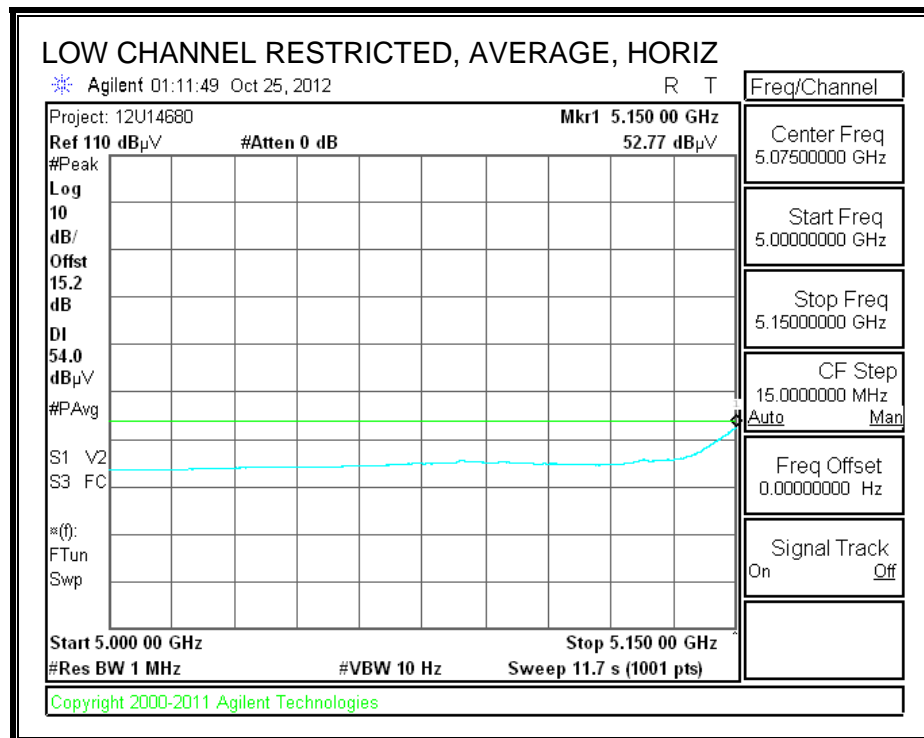
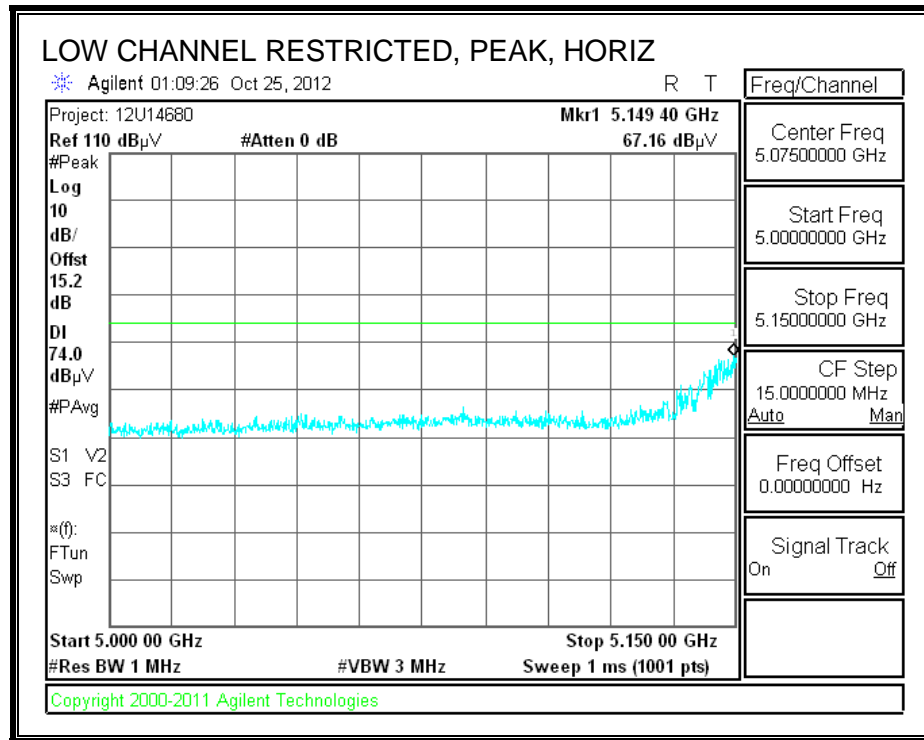
| f GHz | Dist (m) | Read dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Corr. dBuV/m | Limit dBuV/m | Margin dB | Ant. Pol. V/H | Det. P/A/QP | Notes |
|--------------------------|-------------|--------------|------------|----------|-----------|--------------|------------|-----------------|-----------------|--------------|------------------|----------------|-------|
| 5180 MHz 11n HT20 | | | | | | | | | | | | | |
| 15.540 | 3.0 | 34.7 | 39.1 | 13.0 | -31.9 | 0.0 | 0.7 | 55.6 | 74.0 | -18.4 | V | P | |
| 15.540 | 3.0 | 24.4 | 39.1 | 13.0 | -31.9 | 0.0 | 0.7 | 45.2 | 54.0 | -8.8 | V | A | |
| 15.540 | 3.0 | 35.3 | 39.1 | 13.0 | -31.9 | 0.0 | 0.7 | 56.1 | 74.0 | -17.9 | H | P | |
| 15.540 | 3.0 | 24.3 | 39.1 | 13.0 | -31.9 | 0.0 | 0.7 | 45.2 | 54.0 | -8.8 | H | A | |
| 5200 MHz 11n HT20 | | | | | | | | | | | | | |
| 15.600 | 3.0 | 34.5 | 38.8 | 13.0 | -31.9 | 0.0 | 0.7 | 55.1 | 74.0 | -18.9 | H | P | |
| 15.600 | 3.0 | 24.3 | 38.8 | 13.0 | -31.9 | 0.0 | 0.7 | 45.0 | 54.0 | -9.0 | H | A | |
| 15.600 | 3.0 | 34.8 | 38.8 | 13.0 | -31.9 | 0.0 | 0.7 | 55.5 | 74.0 | -18.5 | V | P | |
| 15.600 | 3.0 | 24.3 | 38.8 | 13.0 | -31.9 | 0.0 | 0.7 | 45.0 | 54.0 | -9.0 | V | A | |
| 5240 MHz 11n HT20 | | | | | | | | | | | | | |
| 15.720 | 3.0 | 35.2 | 38.4 | 13.1 | -31.9 | 0.0 | 0.7 | 55.6 | 74.0 | -18.4 | H | P | |
| 15.720 | 3.0 | 24.2 | 38.4 | 13.1 | -31.9 | 0.0 | 0.7 | 44.5 | 54.0 | -9.5 | H | A | |
| 15.720 | 3.0 | 34.4 | 38.4 | 13.1 | -31.9 | 0.0 | 0.7 | 54.7 | 74.0 | -19.3 | V | P | |
| 15.720 | 3.0 | 24.2 | 38.4 | 13.1 | -31.9 | 0.0 | 0.7 | 44.5 | 54.0 | -9.5 | V | A | |

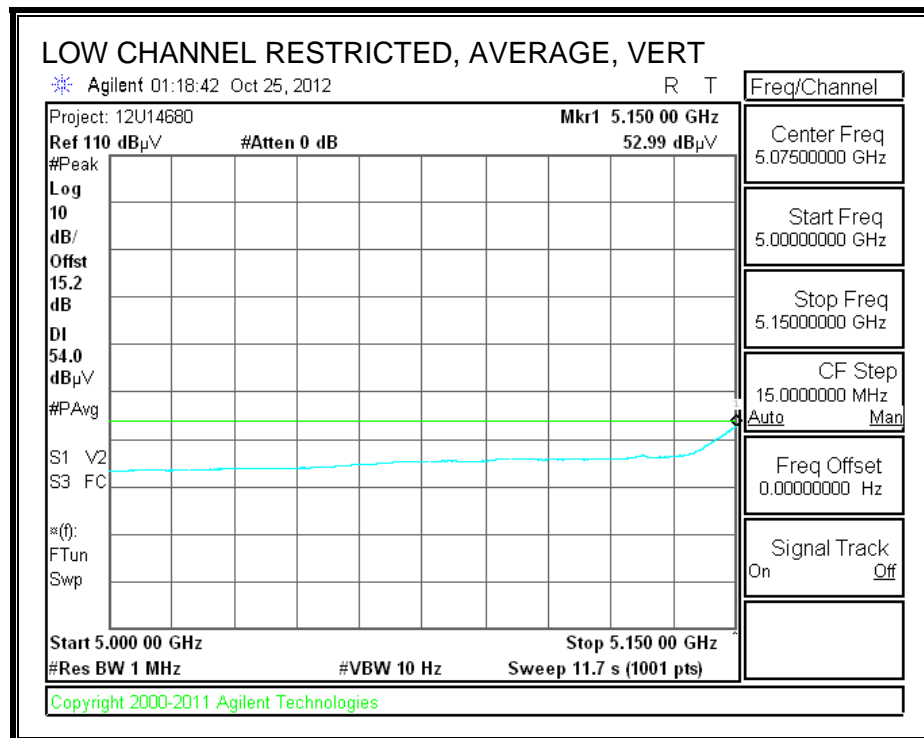
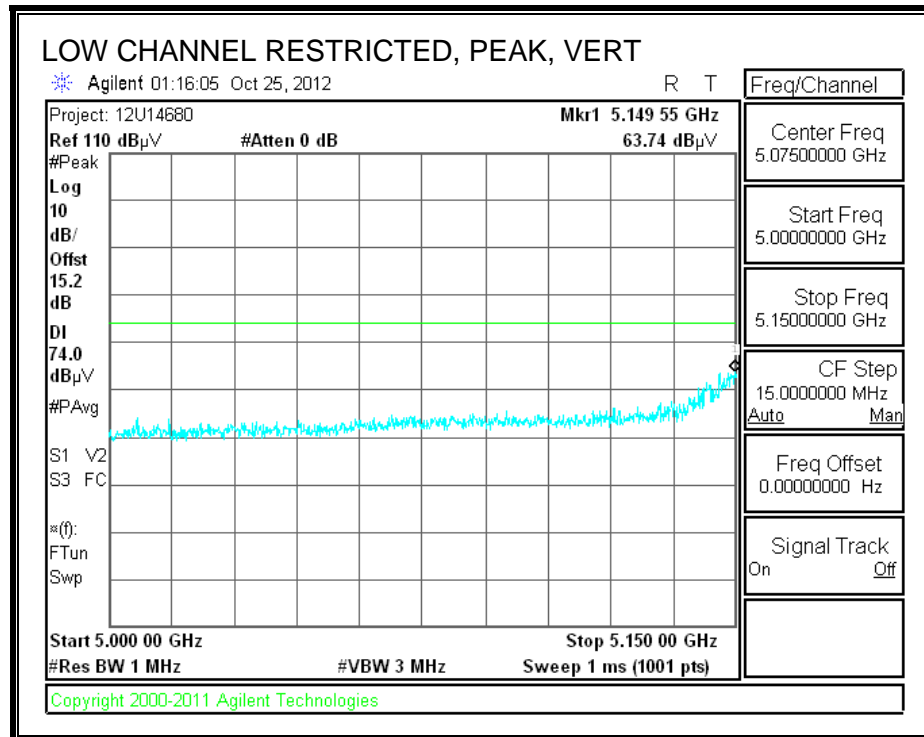
Rev. 4.1.2.7

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

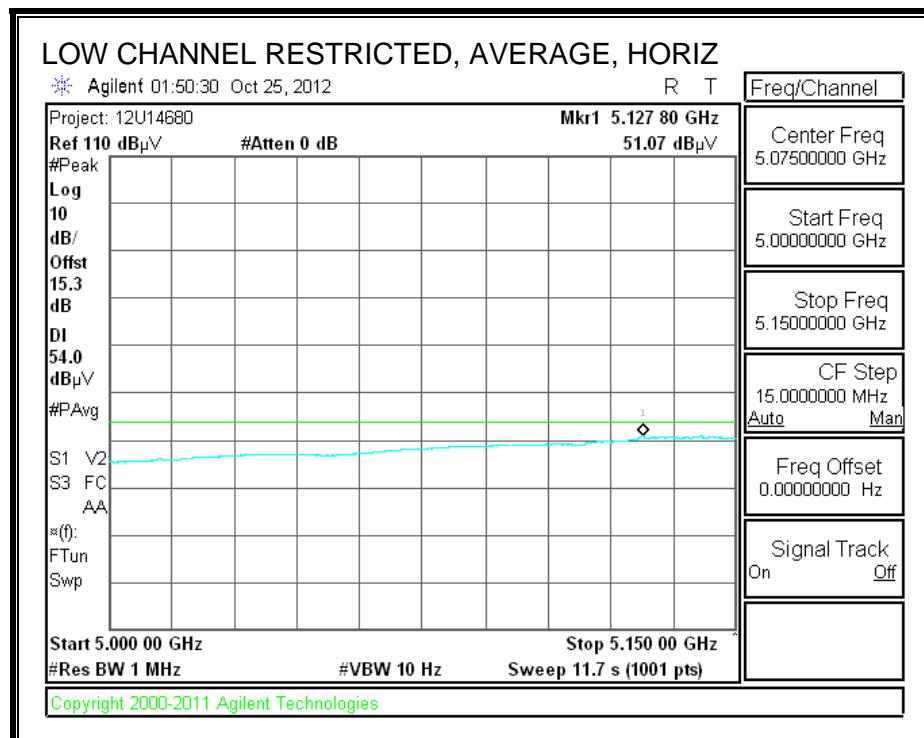
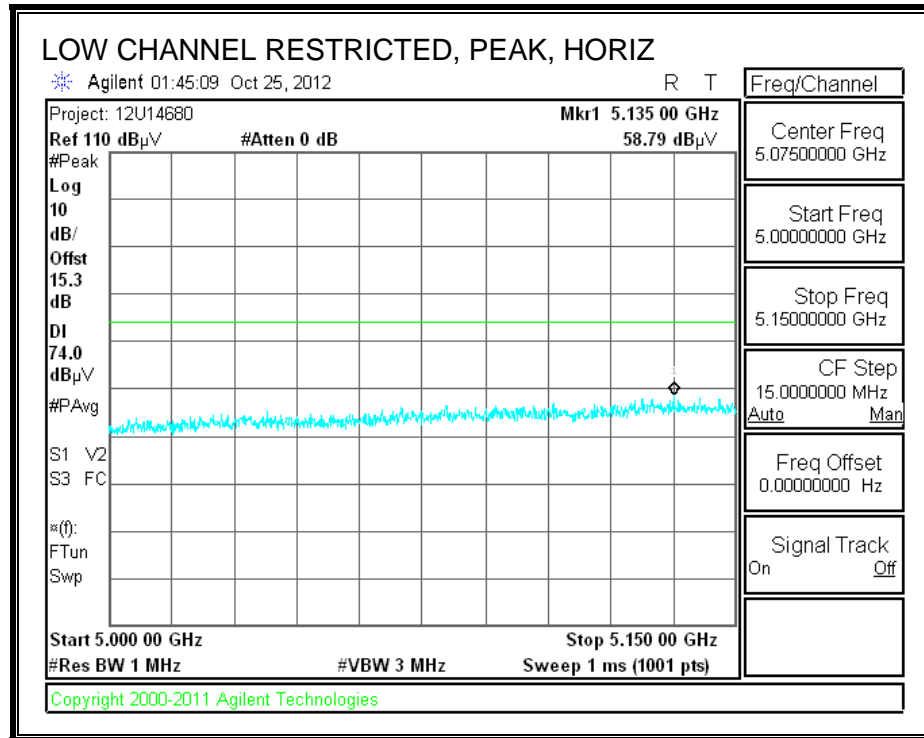
9.4. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.2 GHz BAND

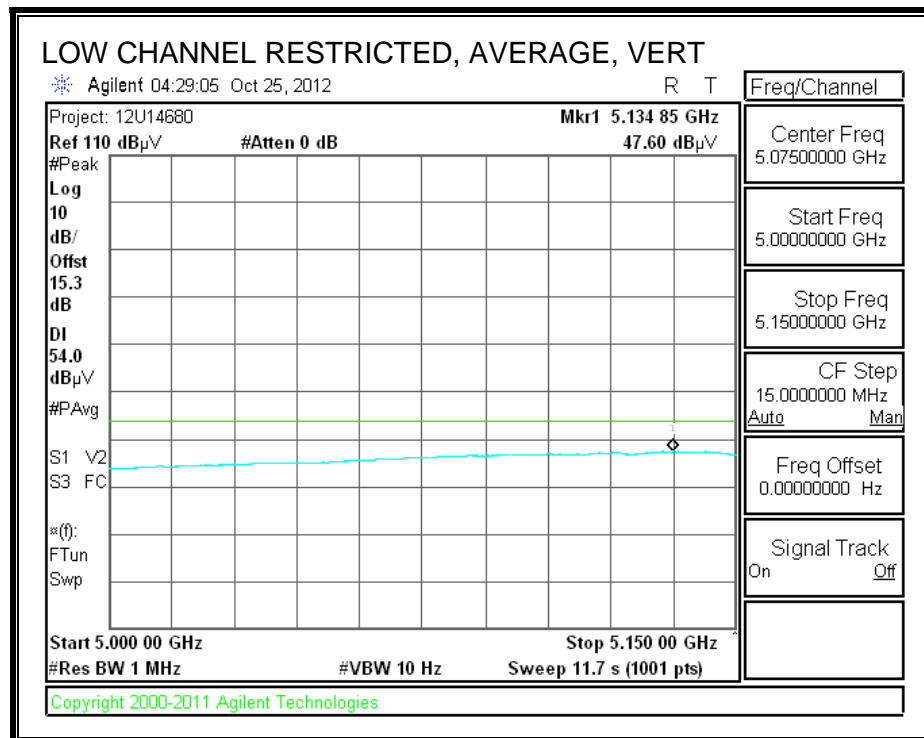
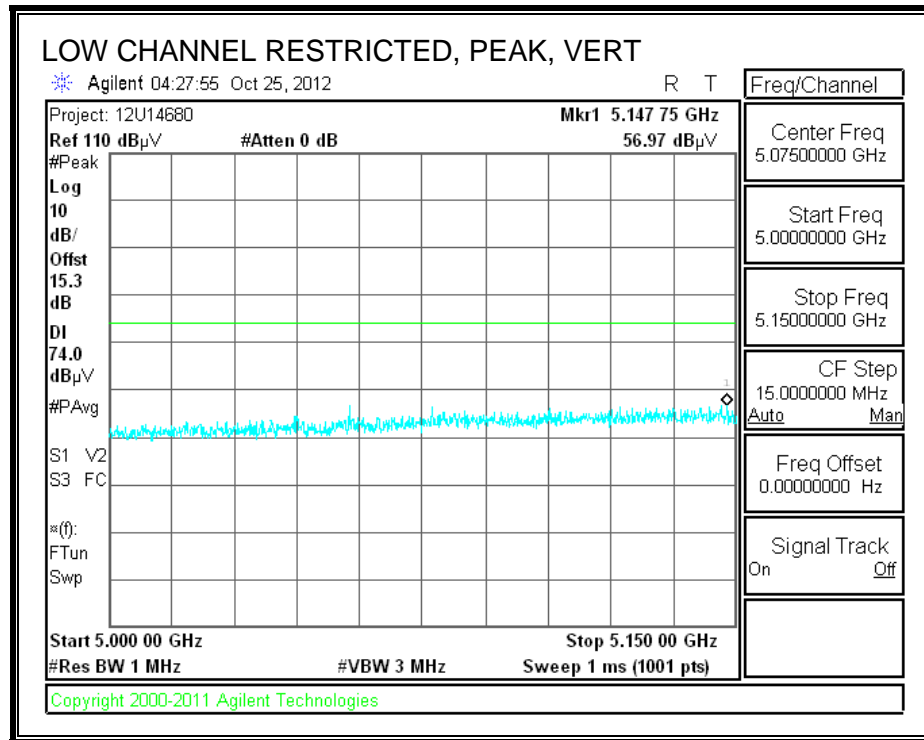
RESTRICTED BANDEDGE (LOW 1 CHANNEL)





RESTRICTED BANDEDGE (LOW 2 CHANNEL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 11/06/12
Project #: 12U14680
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11n HT40 TX 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

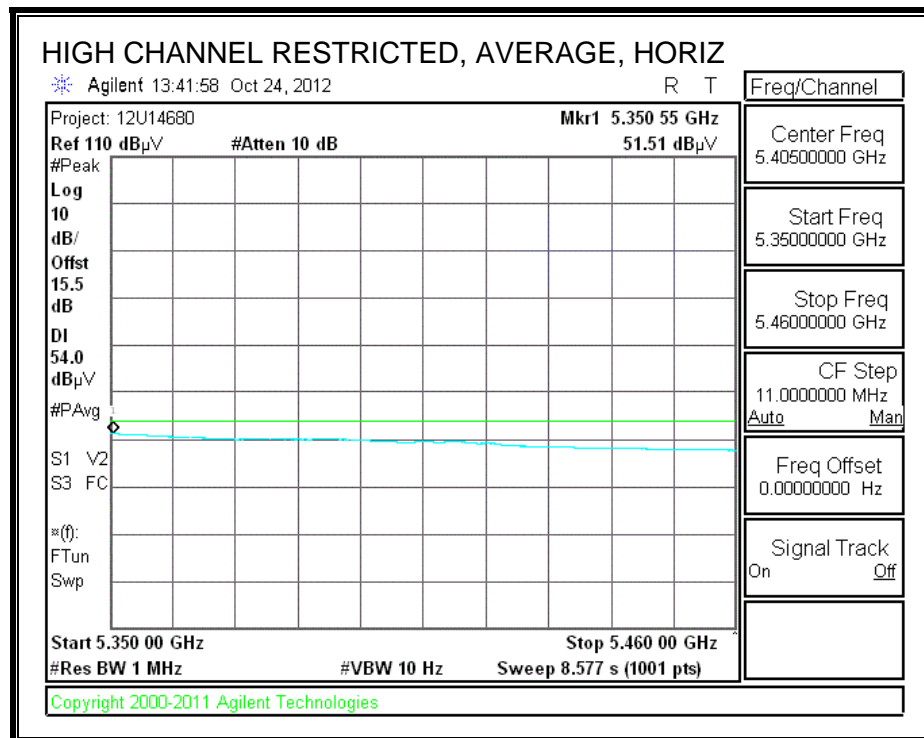
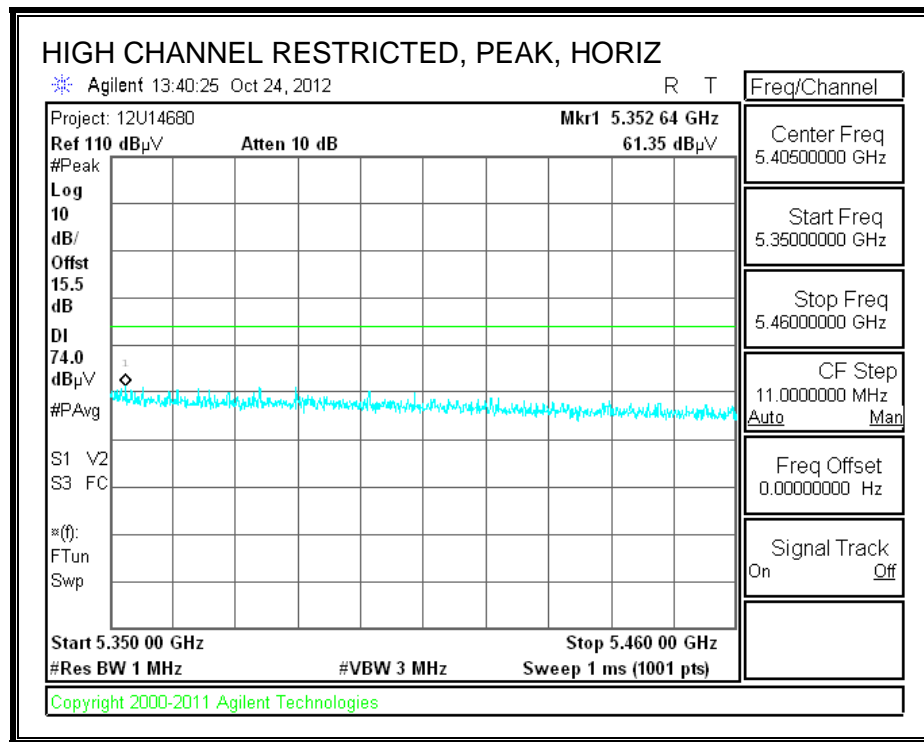
| f GHz | Dist (m) | Read dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Corr. dBuV/m | Limit dBuV/m | Margin dB | Ant. Pol. V/H | Det. P/A/Q/P | Notes |
|---------------------|-------------|--------------|------------|----------|-----------|--------------|------------|-----------------|-----------------|--------------|------------------|-----------------|-------|
| 5190MHz HT40 | | | | | | | | | | | | | |
| 15.570 | 3.0 | 35.1 | 38.9 | 13.0 | -31.9 | 0.0 | 0.7 | 55.8 | 74.0 | -18.2 | H | P | |
| 15.570 | 3.0 | 24.4 | 38.9 | 13.0 | -31.9 | 0.0 | 0.7 | 45.2 | 54.0 | -8.8 | H | A | |
| 5190MHz HT40 | | | | | | | | | | | | | |
| 15.570 | 3.0 | 35.0 | 38.9 | 13.0 | -31.9 | 0.0 | 0.7 | 55.8 | 74.0 | -18.2 | V | P | |
| 15.570 | 3.0 | 24.4 | 38.9 | 13.0 | -31.9 | 0.0 | 0.7 | 45.1 | 54.0 | -8.9 | V | A | |
| 5230MHz HT40 | | | | | | | | | | | | | |
| 15.690 | 3.0 | 35.1 | 38.5 | 13.0 | -31.9 | 0.0 | 0.7 | 55.5 | 74.0 | -18.5 | H | P | |
| 15.690 | 3.0 | 24.4 | 38.5 | 13.0 | -31.9 | 0.0 | 0.7 | 44.8 | 54.0 | -9.2 | H | A | |
| 5230MHz HT40 | | | | | | | | | | | | | |
| 15.690 | 3.0 | 34.7 | 38.5 | 13.0 | -31.9 | 0.0 | 0.7 | 55.1 | 74.0 | -18.9 | V | P | |
| 15.690 | 3.0 | 24.4 | 38.5 | 13.0 | -31.9 | 0.0 | 0.7 | 44.8 | 54.0 | -9.2 | V | A | |

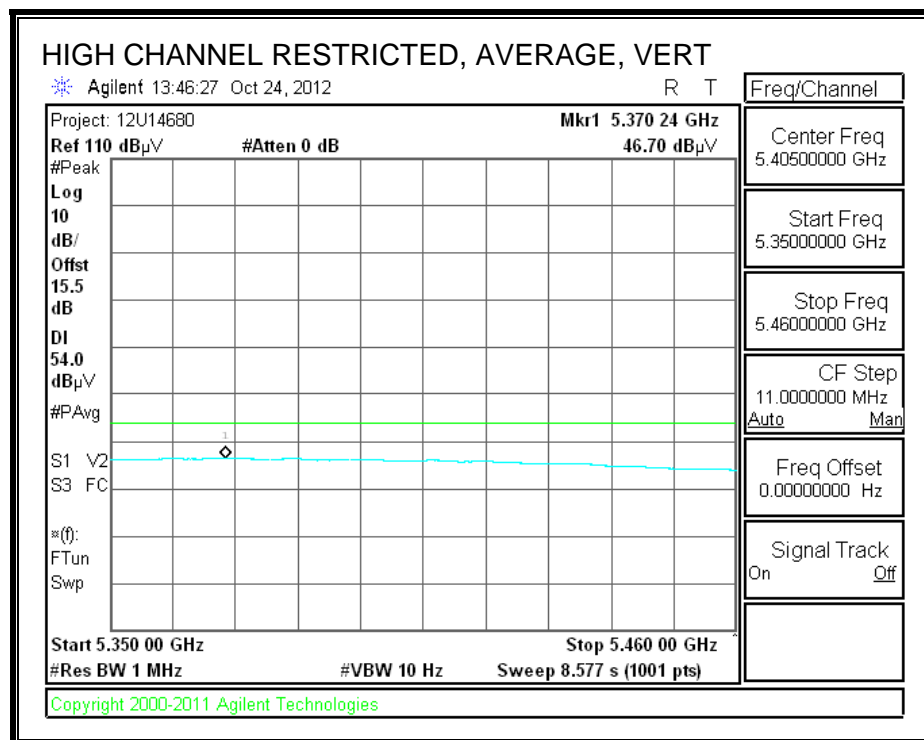
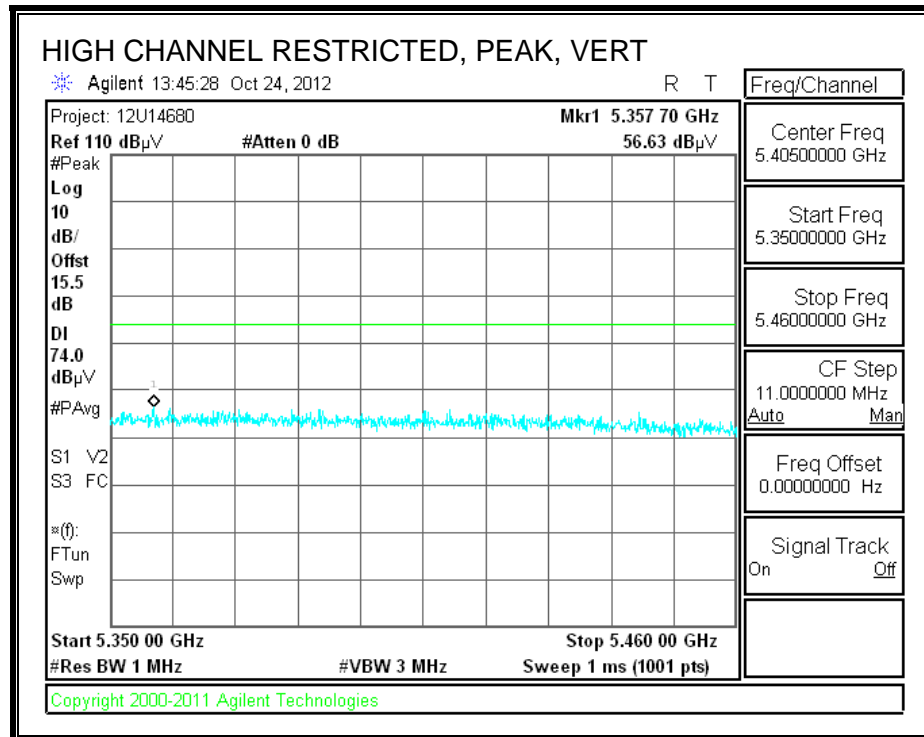
Rev. 4.1.2.7

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

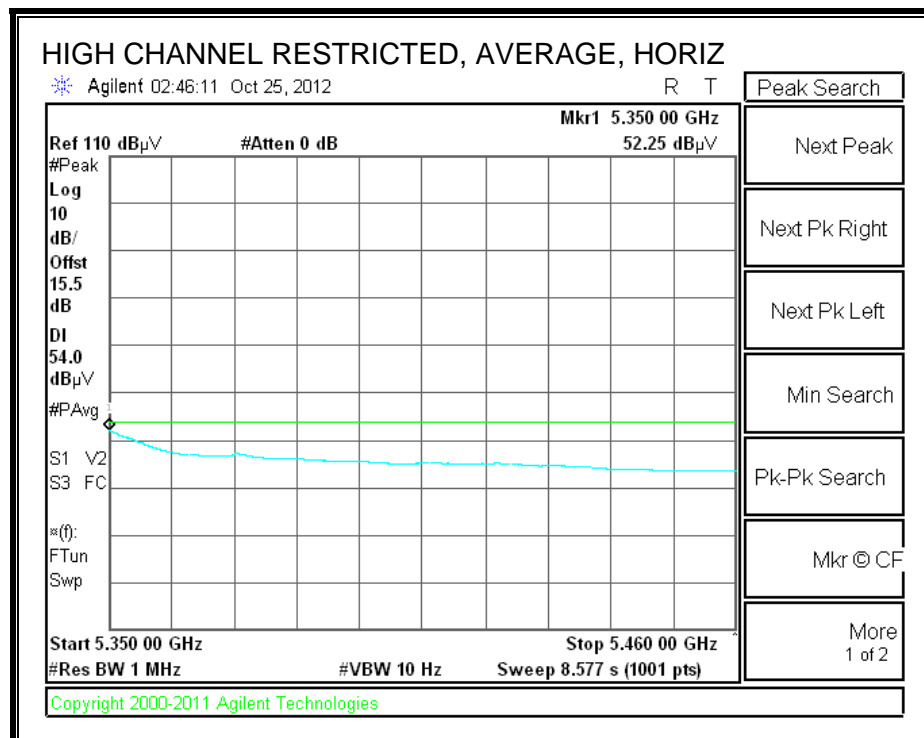
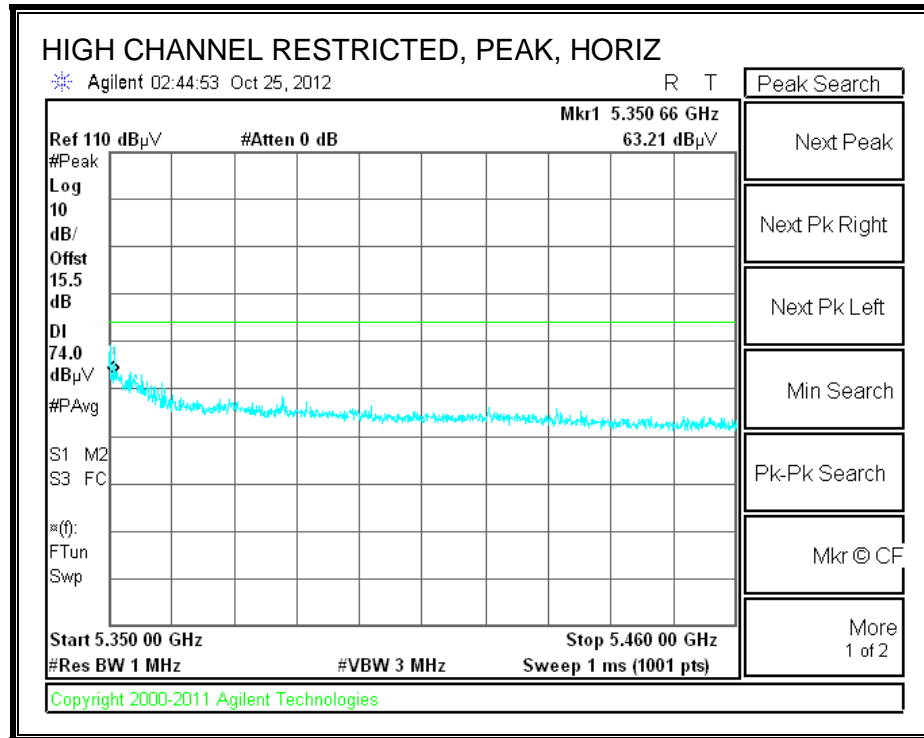
9.5. TX ABOVE 1 GHz 802.11a MODE IN THE 5.3 GHz BAND

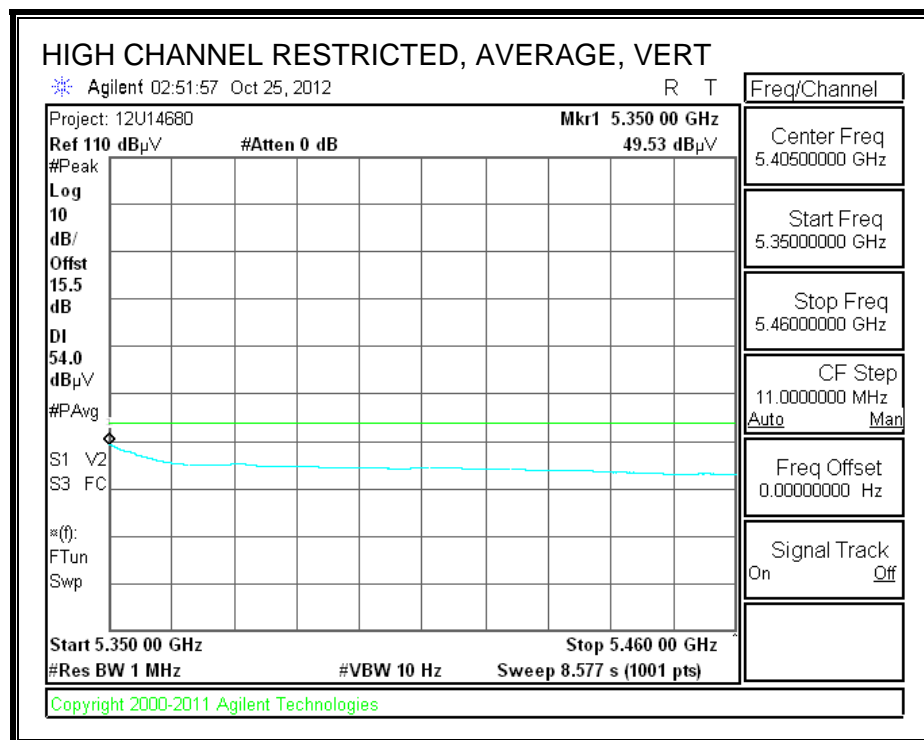
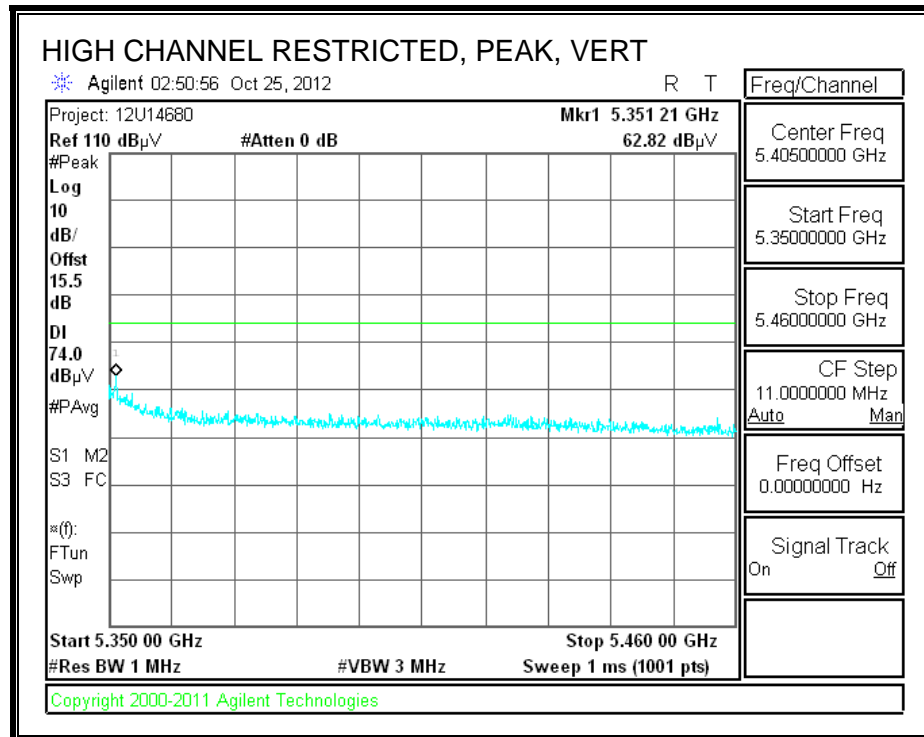
RESTRICTED BANDEDGE (HIGH 1 CHANNEL)





RESTRICTED BANEDGE (HIGH 2 CHANNEL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 11/05/12
Project #: 12U14680
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11a TX 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

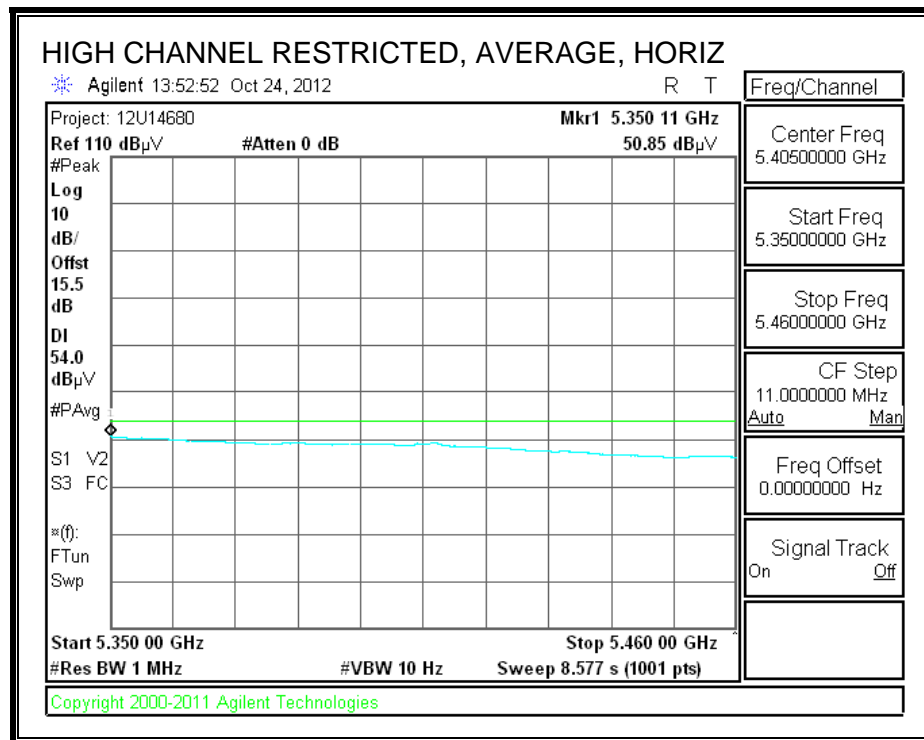
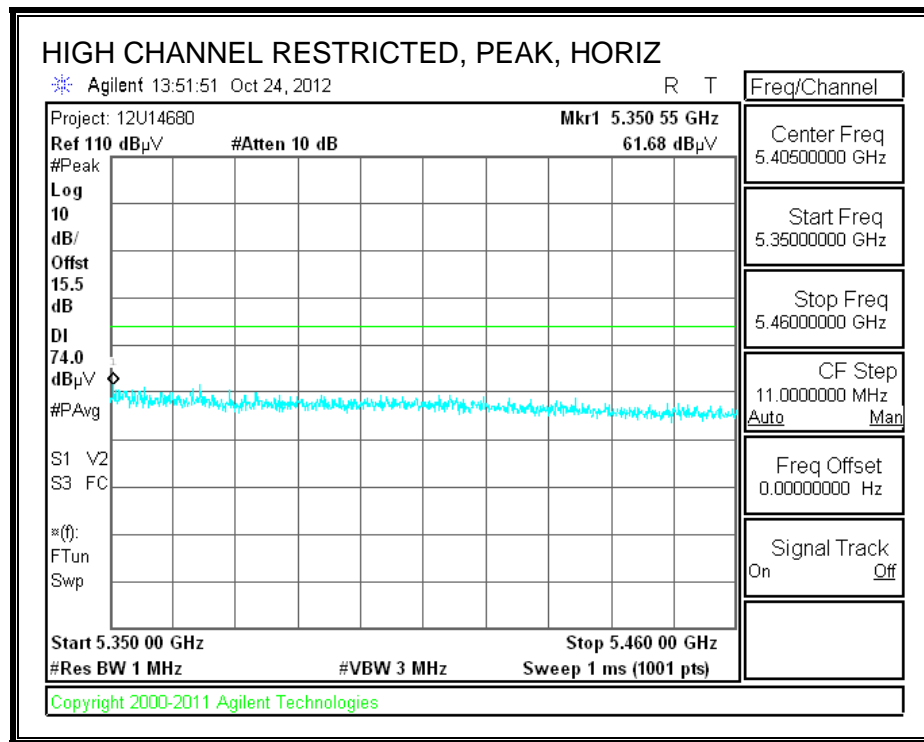
| f GHz | Dist (m) | Read dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Corr. dBuV/m | Limit dBuV/m | Margin dB | Ant. Pol. V/H | Det. P/A/Q/P | Notes |
|---------------------|-------------|--------------|------------|----------|-----------|--------------|------------|-----------------|-----------------|--------------|------------------|-----------------|-------|
| 5260 MHz 11a | | | | | | | | | | | | | |
| 15.780 | 3.0 | 34.5 | 38.2 | 13.1 | -31.9 | 0.0 | 0.7 | 54.7 | 74.0 | -19.3 | V | P | |
| 15.780 | 3.0 | 24.0 | 38.2 | 13.1 | -31.9 | 0.0 | 0.7 | 44.2 | 54.0 | -9.8 | V | A | |
| 15.780 | 3.0 | 34.3 | 38.2 | 13.1 | -31.9 | 0.0 | 0.7 | 54.4 | 74.0 | -19.6 | H | P | |
| 15.780 | 3.0 | 24.0 | 38.2 | 13.1 | -31.9 | 0.0 | 0.7 | 44.1 | 54.0 | -9.9 | H | A | |
| 5300 MHz 11a | | | | | | | | | | | | | |
| 15.900 | 3.0 | 34.4 | 37.8 | 13.2 | -31.8 | 0.0 | 0.7 | 54.2 | 74.0 | -19.8 | H | P | |
| 15.900 | 3.0 | 24.1 | 37.8 | 13.2 | -31.8 | 0.0 | 0.7 | 43.9 | 54.0 | -10.1 | H | A | |
| 15.900 | 3.0 | 34.7 | 37.8 | 13.2 | -31.8 | 0.0 | 0.7 | 54.5 | 74.0 | -19.5 | V | P | |
| 15.900 | 3.0 | 24.1 | 37.8 | 13.2 | -31.8 | 0.0 | 0.7 | 43.9 | 54.0 | -10.1 | V | A | |
| 5320 MHz 11a | | | | | | | | | | | | | |
| 15.960 | 3.0 | 34.6 | 37.8 | 13.2 | -31.8 | 0.0 | 0.7 | 54.4 | 74.0 | -19.6 | V | P | |
| 15.960 | 3.0 | 24.1 | 37.8 | 13.2 | -31.8 | 0.0 | 0.7 | 43.9 | 54.0 | -10.1 | V | A | |
| 15.960 | 3.0 | 34.6 | 37.8 | 13.2 | -31.8 | 0.0 | 0.7 | 54.4 | 74.0 | -19.6 | H | P | |
| 15.960 | 3.0 | 24.1 | 37.8 | 13.2 | -31.8 | 0.0 | 0.7 | 43.9 | 54.0 | -10.1 | H | A | |

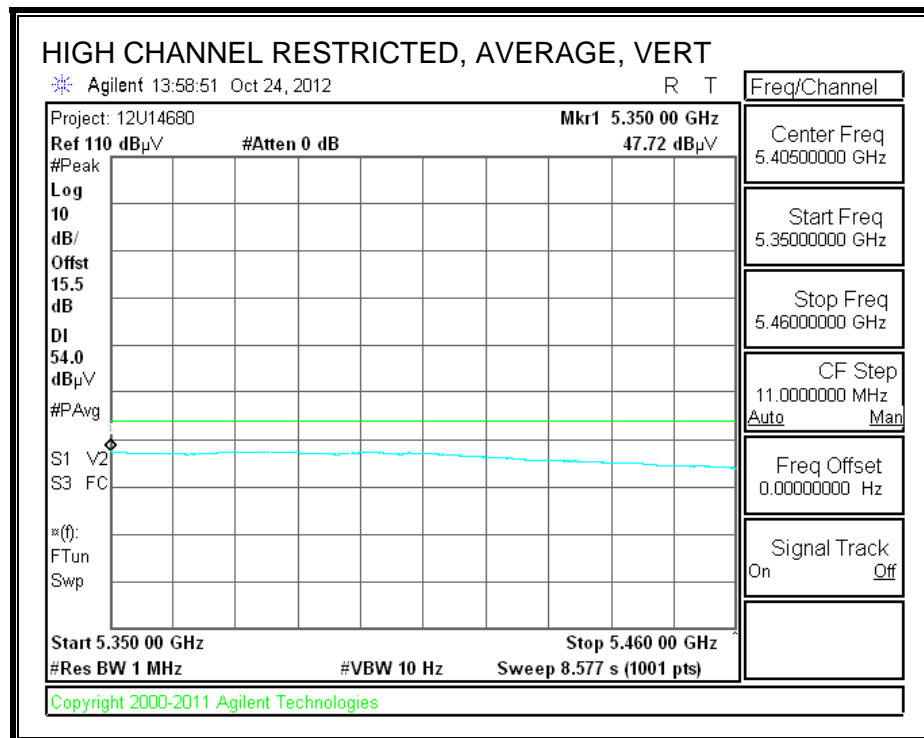
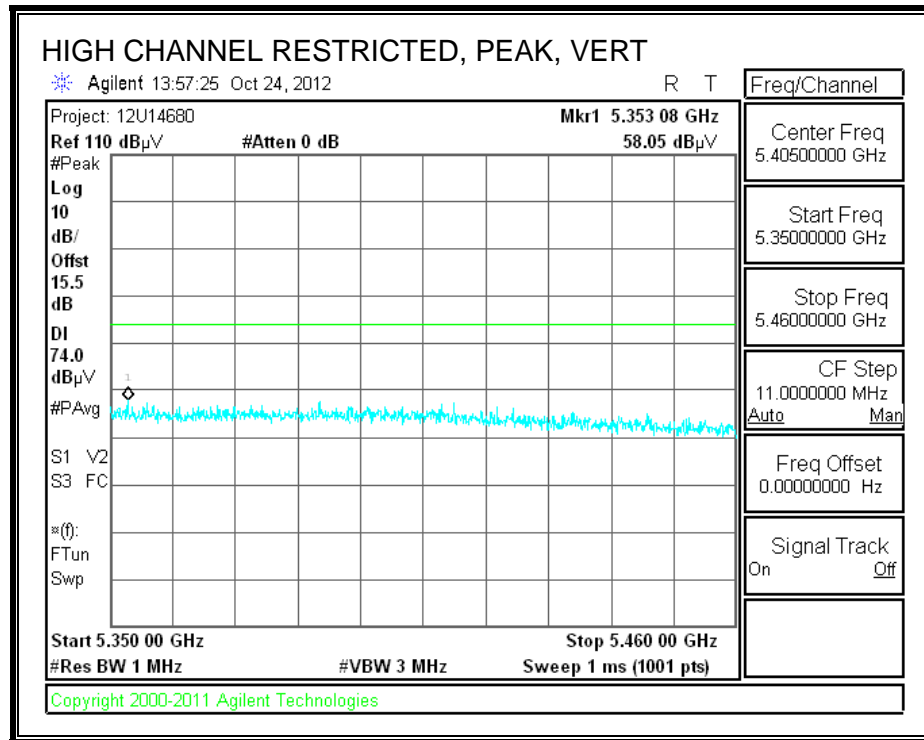
Rev. 4.1.2.7

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

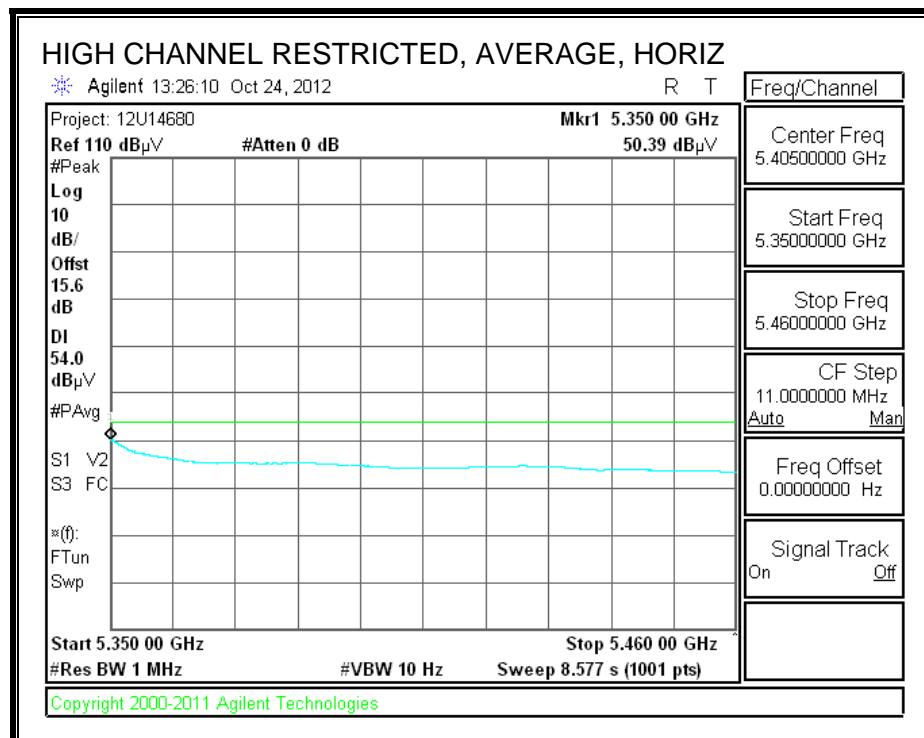
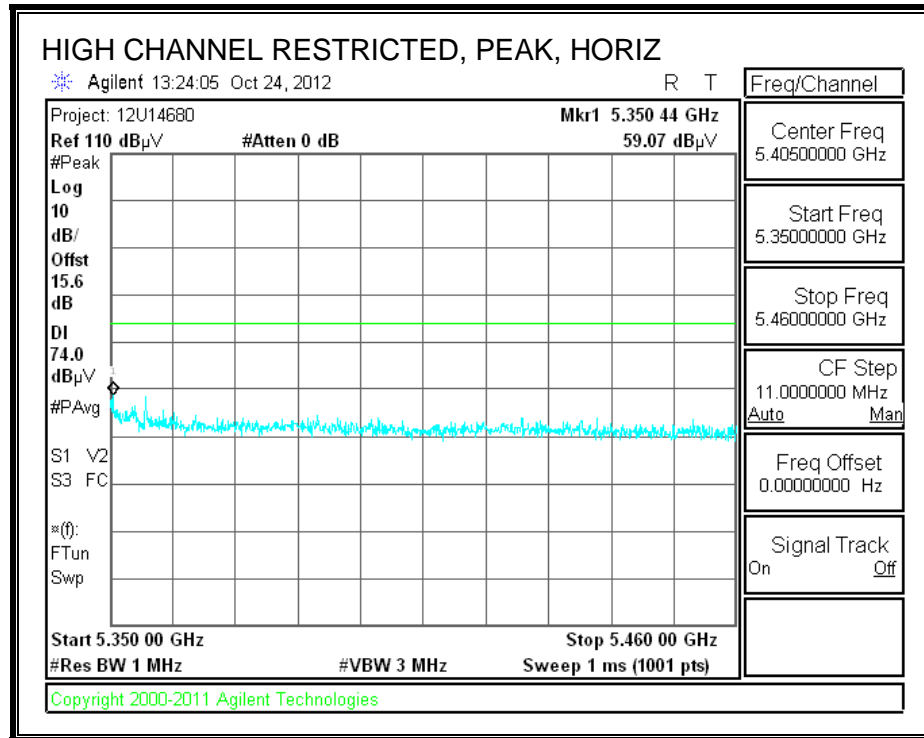
9.6. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.3 GHz BAND

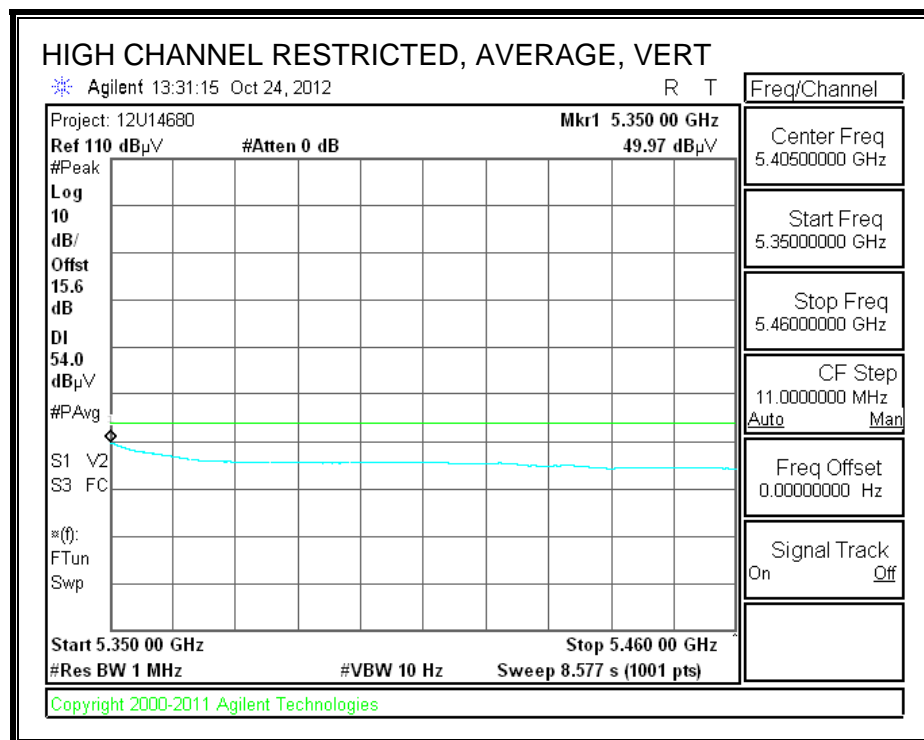
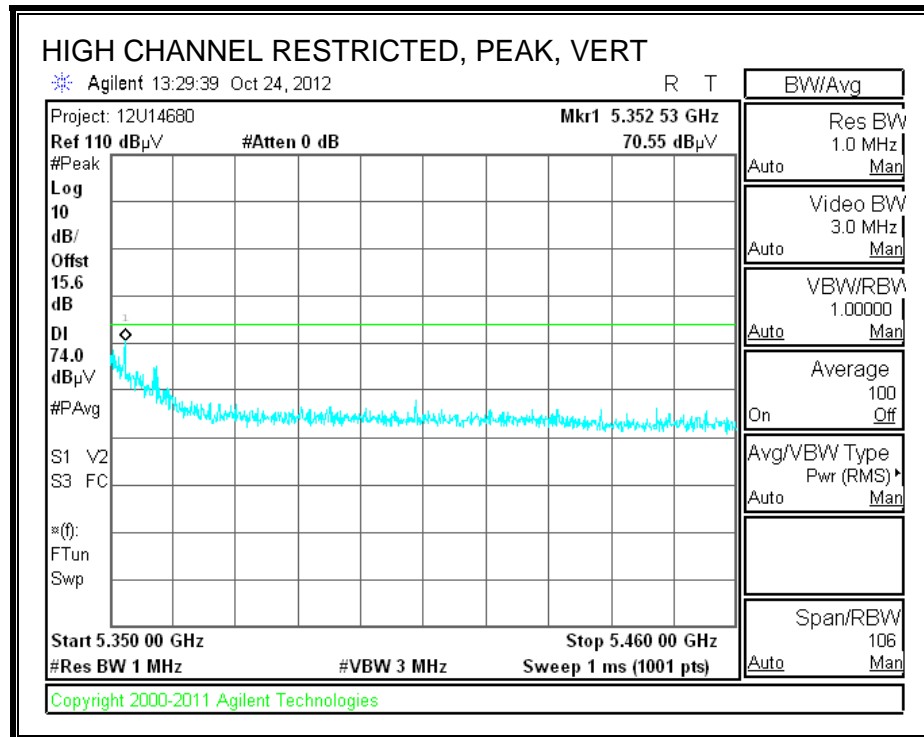
RESTRICTED BANDEDGE (HIGH 1 CHANNEL)





RESTRICTED BANEDGE (HIGH 2 CHANNEL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 11/06/12
Project #: 12U14680
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11n HT20 TX 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

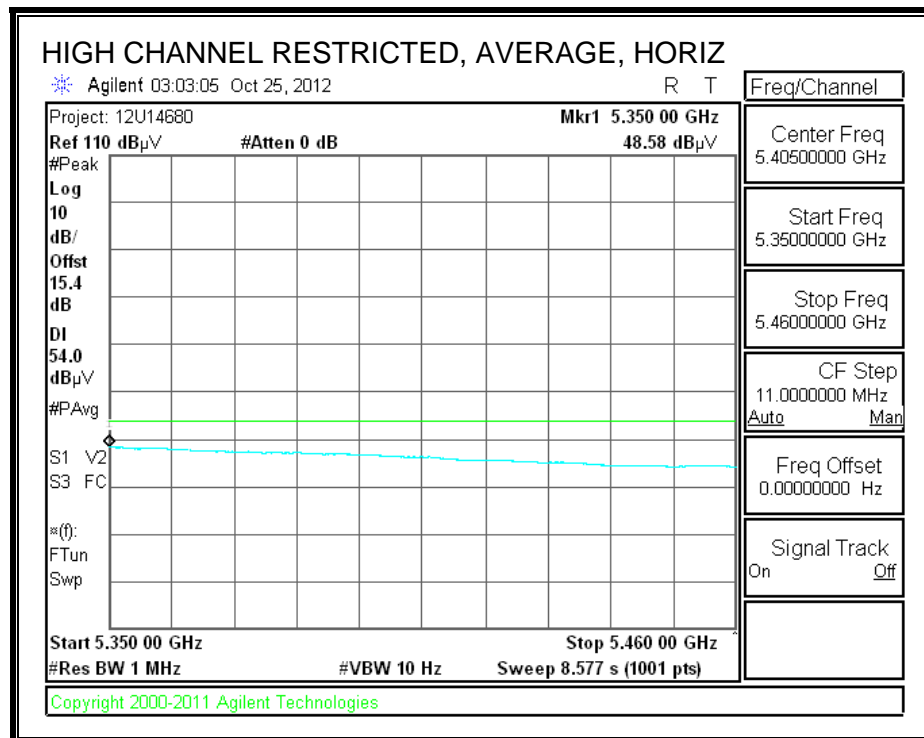
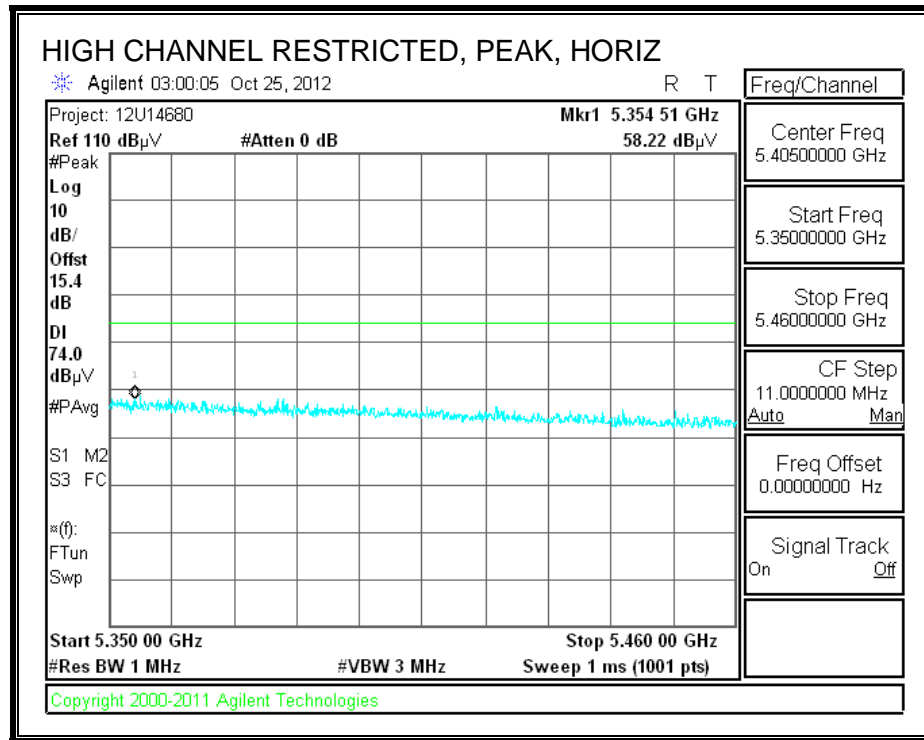
| f GHz | Dist (m) | Read dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Corr. dBuV/m | Limit dBuV/m | Margin dB | Ant. Pol. V/H | Det. P/A/Q/P | Notes |
|----------------------|-------------|--------------|------------|----------|-----------|--------------|------------|-----------------|-----------------|--------------|------------------|-----------------|-------|
| 5260 MHz HT20 | | | | | | | | | | | | | |
| 15.780 | 3.0 | 34.9 | 38.2 | 13.1 | -31.9 | 0.0 | 0.7 | 55.1 | 74.0 | -18.9 | H | P | |
| 15.780 | 3.0 | 24.0 | 38.2 | 13.1 | -31.9 | 0.0 | 0.7 | 44.2 | 54.0 | -9.8 | H | A | |
| 15.780 | 3.0 | 34.1 | 38.2 | 13.1 | -31.9 | 0.0 | 0.7 | 54.3 | 74.0 | -19.7 | V | P | |
| 15.780 | 3.0 | 24.0 | 38.2 | 13.1 | -31.9 | 0.0 | 0.7 | 44.2 | 54.0 | -9.8 | V | A | |
| 5300 MHz HT20 | | | | | | | | | | | | | |
| 15.900 | 3.0 | 34.4 | 37.8 | 13.2 | -31.8 | 0.0 | 0.7 | 54.2 | 74.0 | -19.8 | H | P | |
| 15.900 | 3.0 | 24.2 | 37.8 | 13.2 | -31.8 | 0.0 | 0.7 | 44.0 | 54.0 | -10.0 | H | A | |
| 15.900 | 3.0 | 34.6 | 37.8 | 13.2 | -31.8 | 0.0 | 0.7 | 54.4 | 74.0 | -19.6 | V | P | |
| 15.900 | 3.0 | 24.2 | 37.8 | 13.2 | -31.8 | 0.0 | 0.7 | 44.0 | 54.0 | -10.0 | V | A | |
| 5320 MHz HT20 | | | | | | | | | | | | | |
| 15.960 | 3.0 | 35.1 | 37.6 | 13.2 | -31.8 | 0.0 | 0.7 | 54.7 | 74.0 | -19.3 | H | P | |
| 15.960 | 3.0 | 24.3 | 37.6 | 13.2 | -31.8 | 0.0 | 0.7 | 43.9 | 54.0 | -10.1 | H | A | |
| 15.960 | 3.0 | 34.8 | 37.6 | 13.2 | -31.8 | 0.0 | 0.7 | 54.4 | 74.0 | -19.6 | V | P | |
| 15.960 | 3.0 | 24.3 | 37.6 | 13.2 | -31.8 | 0.0 | 0.7 | 44.0 | 54.0 | -10.0 | V | A | |

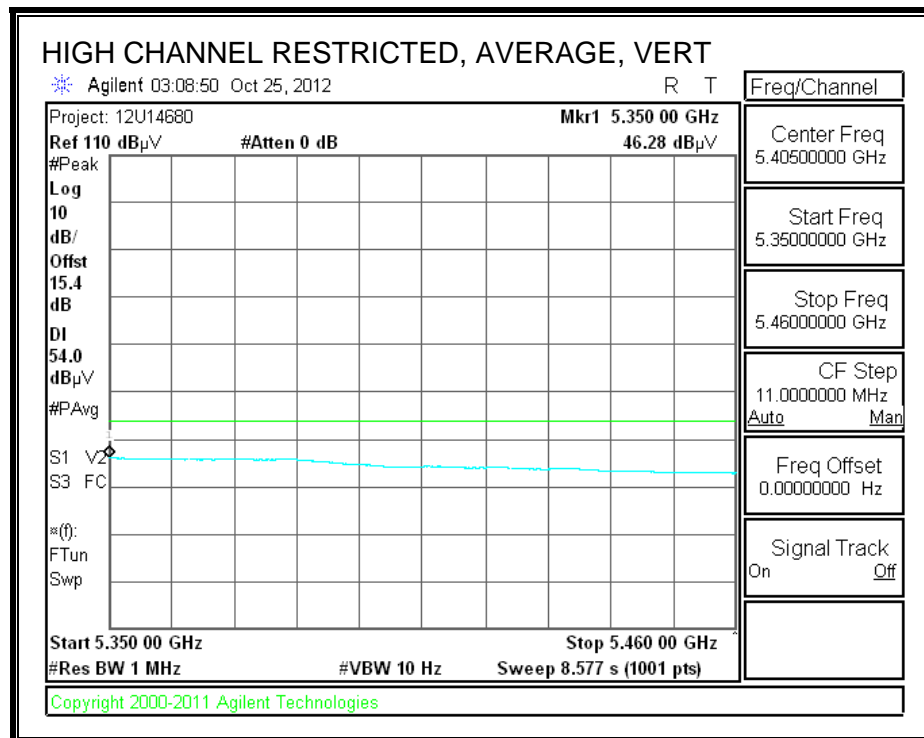
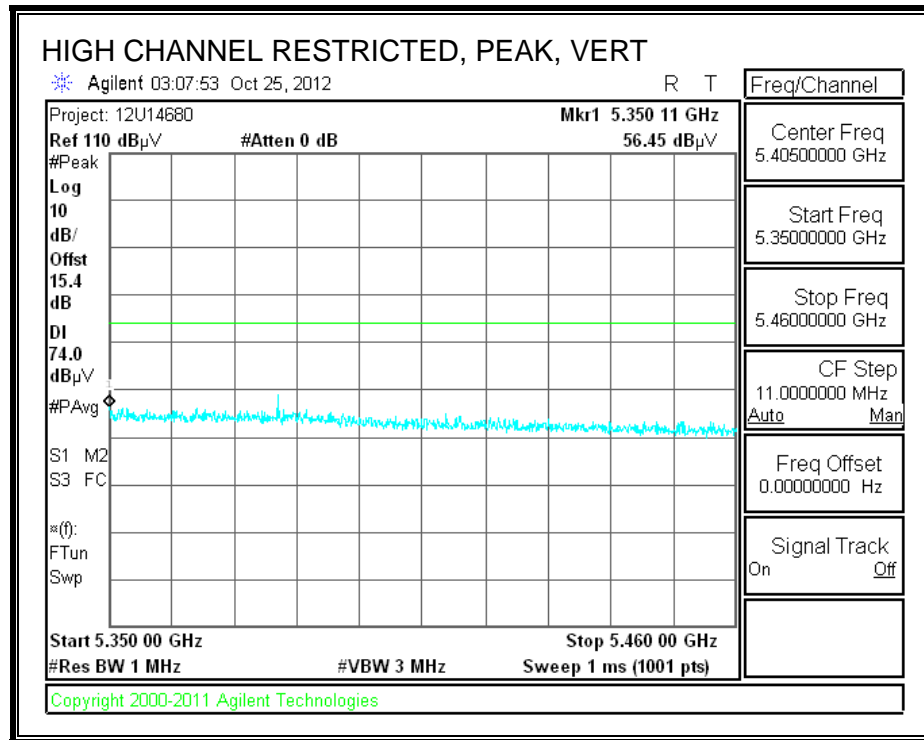
Rev. 4.1.2.7

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

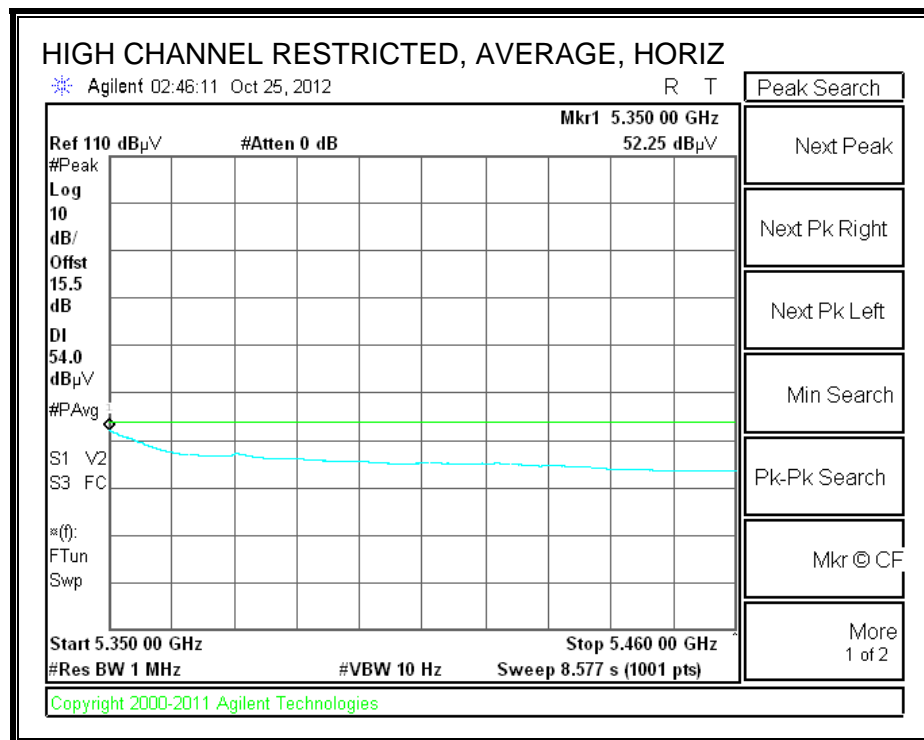
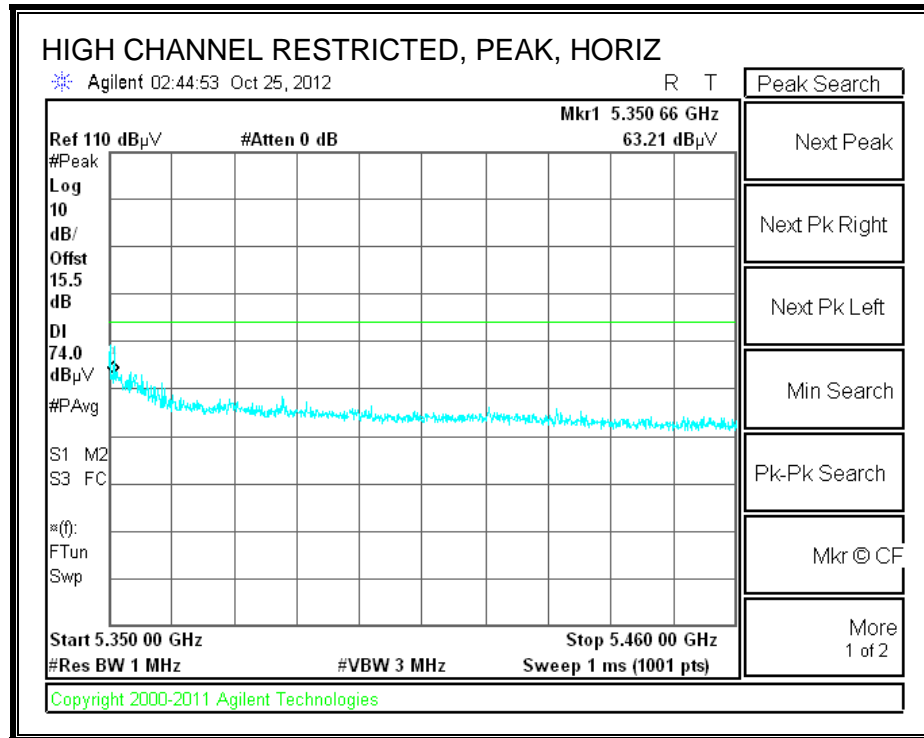
9.7. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.3 GHz BAND

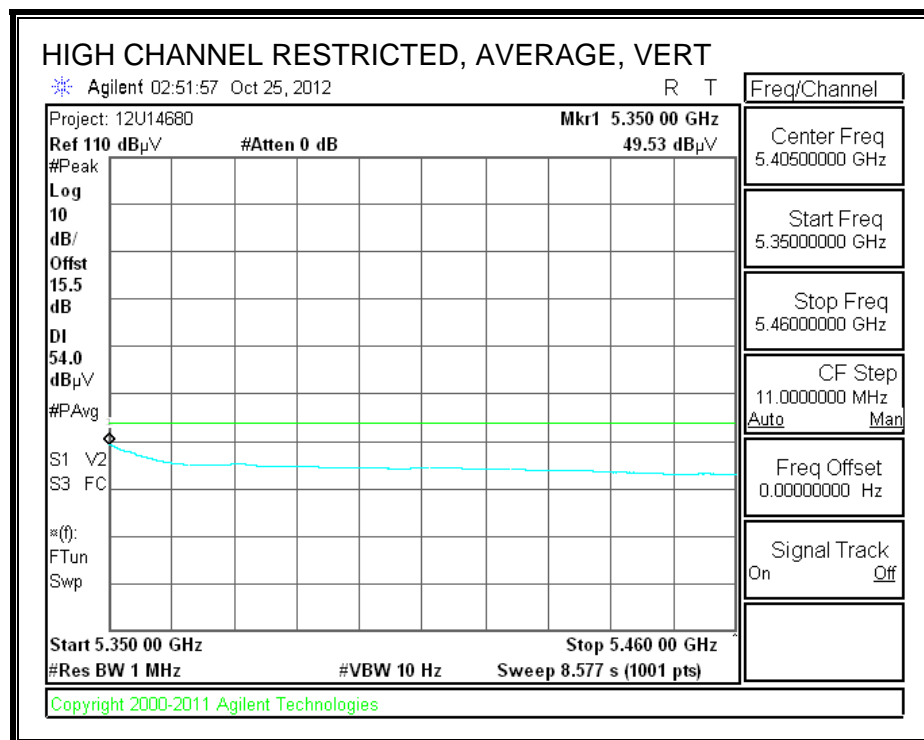
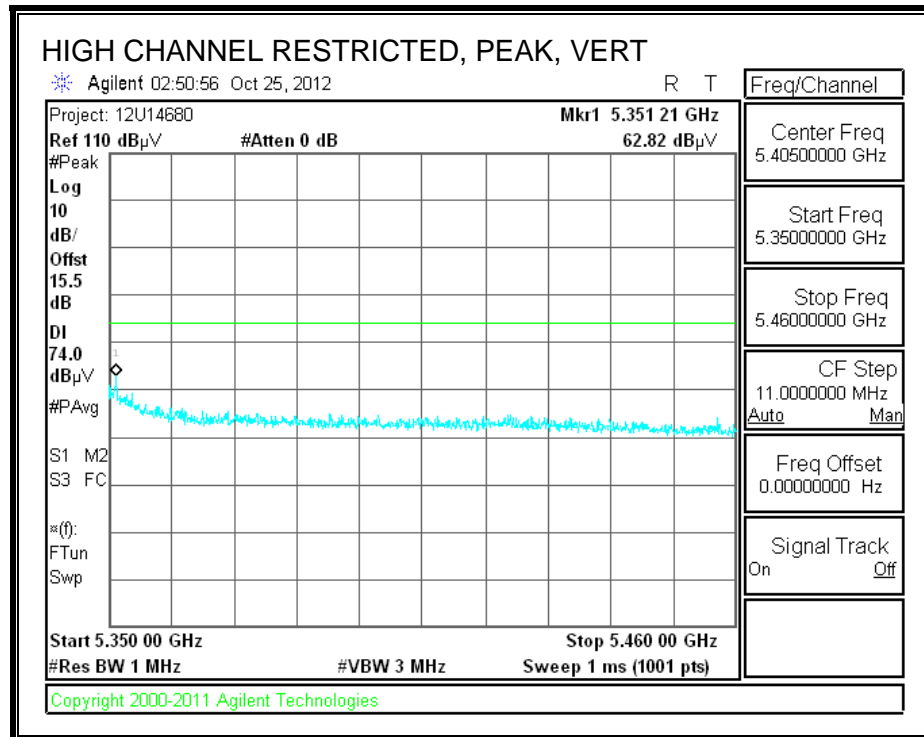
RESTRICTED BANDEDGE (HIGH 1 CHANNEL)





RESTRICTED BANDEDGE (HIGH 2 CHANNEL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 11/06/12
Project #: 12U14680
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11n HT40 TX 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

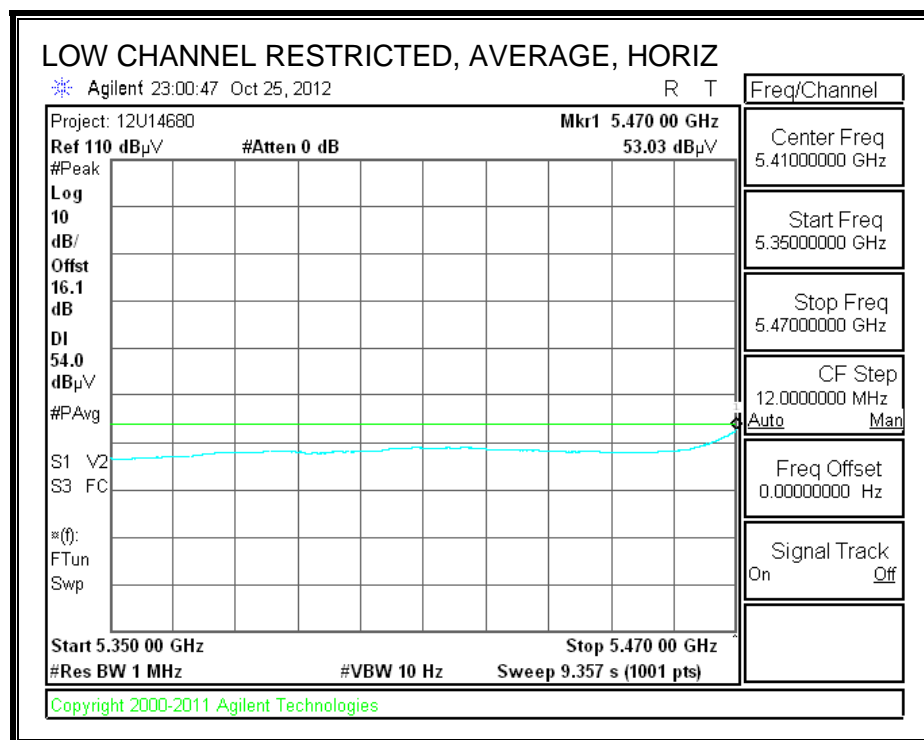
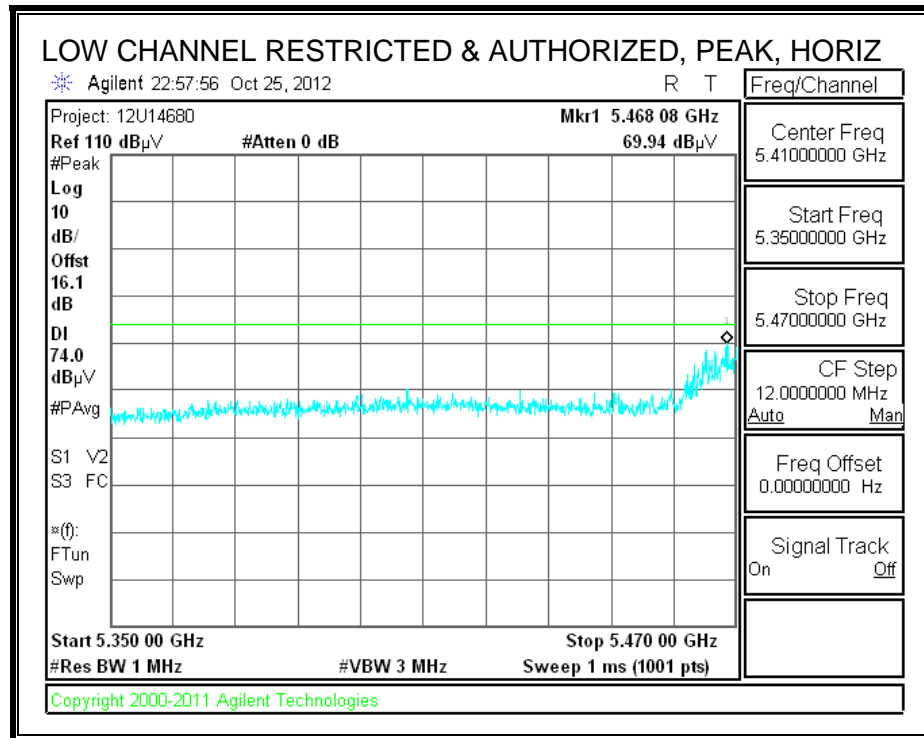
| f GHz | Dist (m) | Read dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Corr. dBuV/m | Limit dBuV/m | Margin dB | Ant. Pol. V/H | Det. P/A/Q/P | Notes |
|---------------------|-------------|--------------|------------|----------|-----------|--------------|------------|-----------------|-----------------|--------------|------------------|-----------------|-------|
| 5270MHz HT40 | | | | | | | | | | | | | |
| 15.810 | 3.0 | 34.0 | 38.1 | 13.1 | -31.9 | 0.0 | 0.7 | 54.1 | 74.0 | -19.9 | H | P | |
| 15.810 | 3.0 | 24.1 | 38.1 | 13.1 | -31.9 | 0.0 | 0.7 | 44.1 | 54.0 | -9.9 | H | A | |
| 5270MHz HT40 | | | | | | | | | | | | | |
| 15.810 | 3.0 | 34.4 | 38.1 | 13.1 | -31.9 | 0.0 | 0.7 | 54.4 | 74.0 | -19.6 | V | P | |
| 15.810 | 3.0 | 24.0 | 38.1 | 13.1 | -31.9 | 0.0 | 0.7 | 44.1 | 54.0 | -9.9 | V | A | |
| 5310MHz HT40 | | | | | | | | | | | | | |
| 15.930 | 3.0 | 34.8 | 37.7 | 13.2 | -31.8 | 0.0 | 0.7 | 54.6 | 74.0 | -19.4 | H | P | |
| 15.930 | 3.0 | 24.3 | 37.7 | 13.2 | -31.8 | 0.0 | 0.7 | 44.0 | 54.0 | -10.0 | H | A | |
| 5310MHz HT40 | | | | | | | | | | | | | |
| 15.930 | 3.0 | 35.0 | 37.7 | 13.2 | -31.8 | 0.0 | 0.7 | 54.8 | 74.0 | -19.2 | V | P | |
| 15.930 | 3.0 | 24.3 | 37.7 | 13.2 | -31.8 | 0.0 | 0.7 | 44.0 | 54.0 | -10.0 | V | A | |

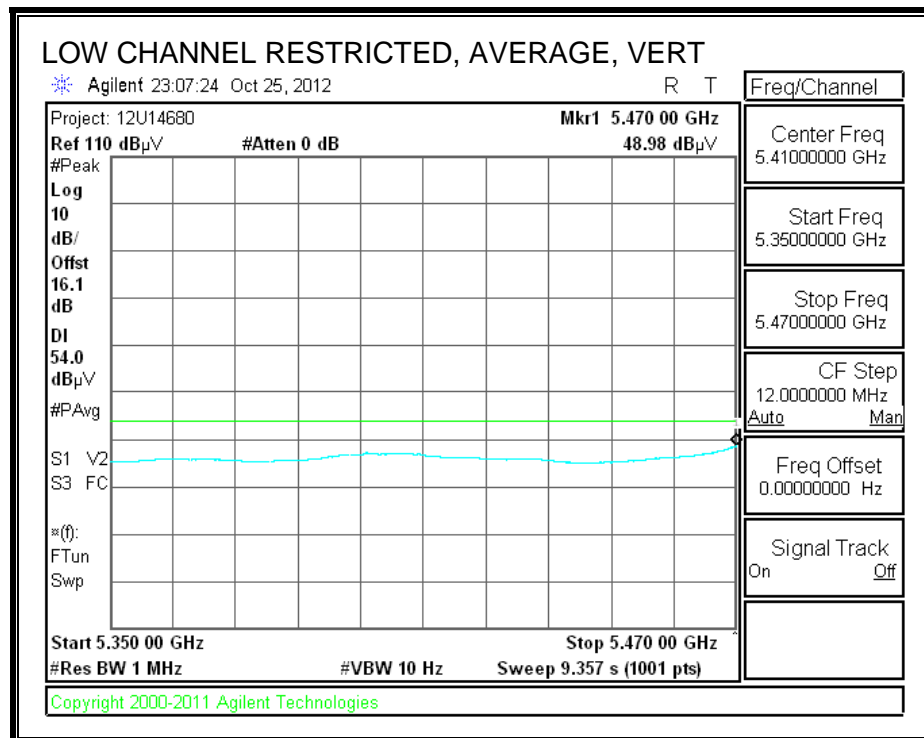
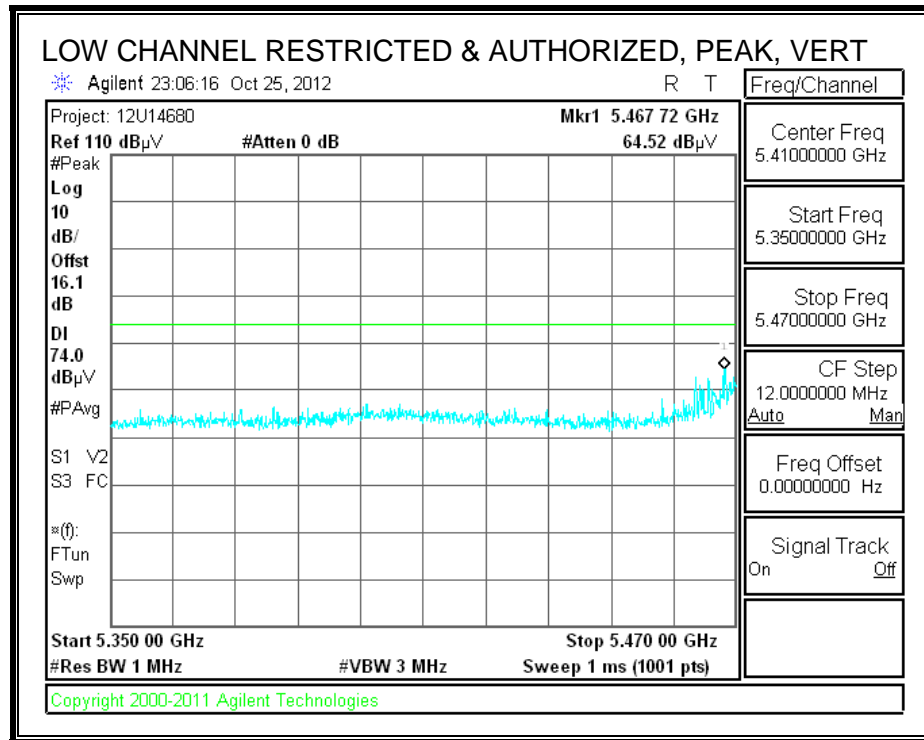
Rev. 4.1.2.7

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

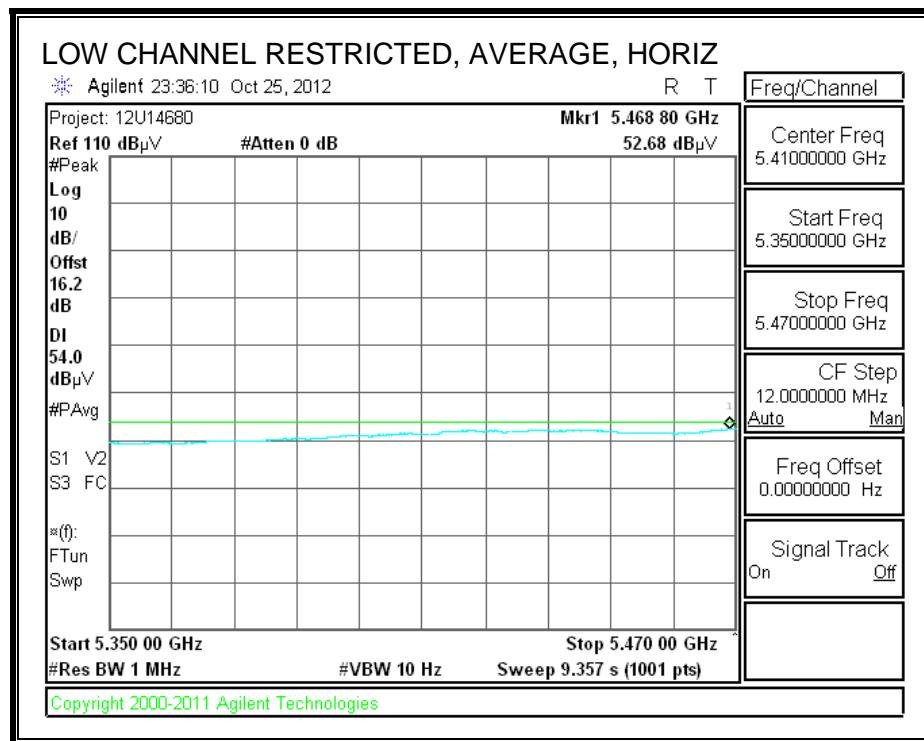
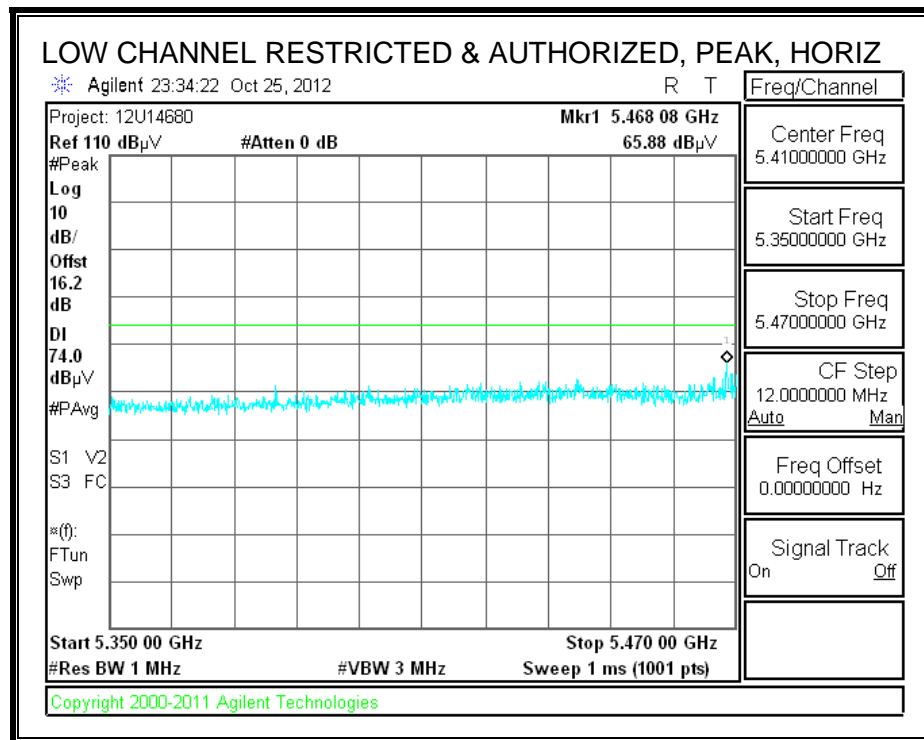
9.8. TX ABOVE 1 GHz 802.11a MODE IN THE 5.6 GHz BAND

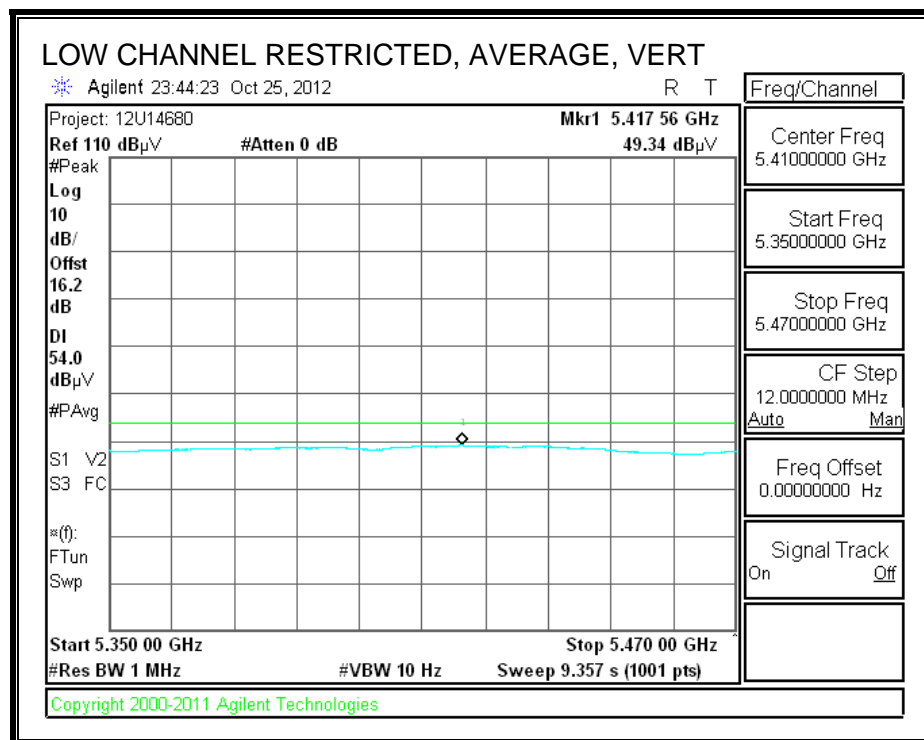
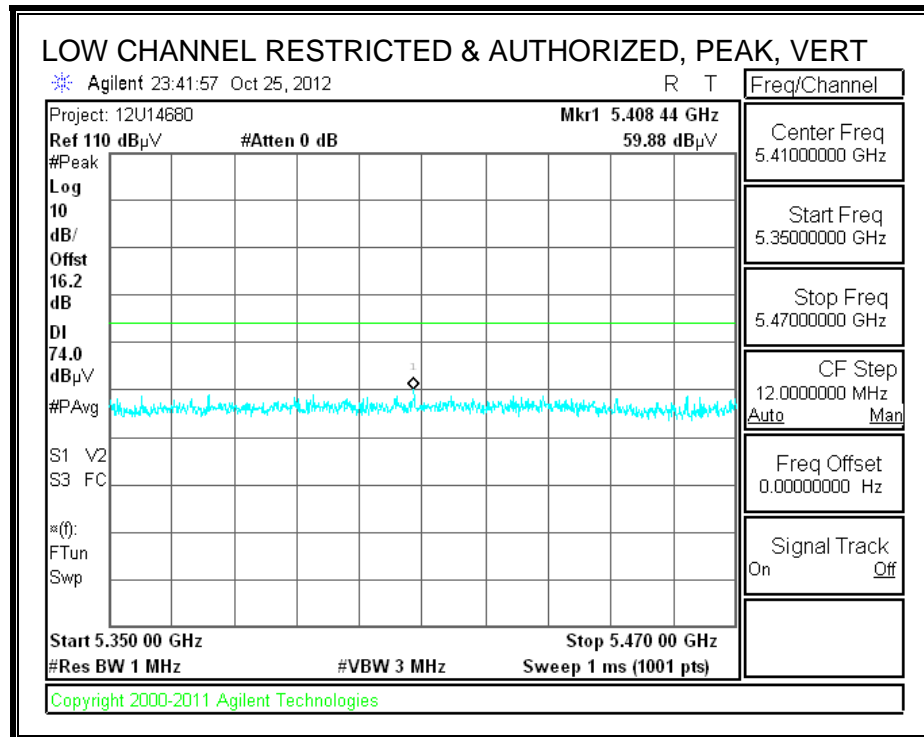
RESTRICTED & AUTHORIZED BANDEDGE (LOW 1 CHANNEL)



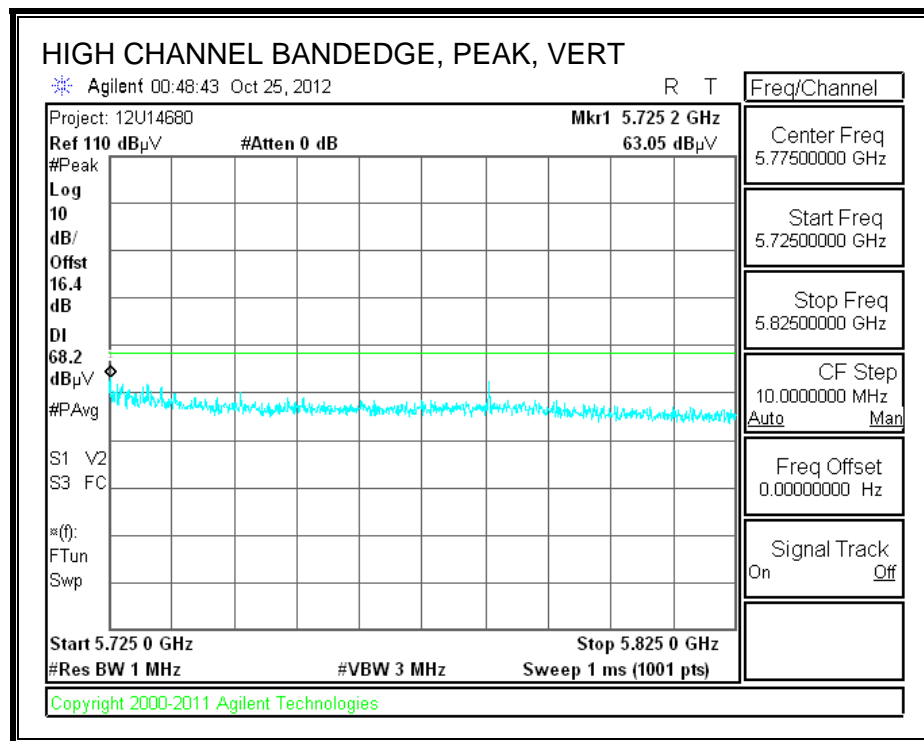
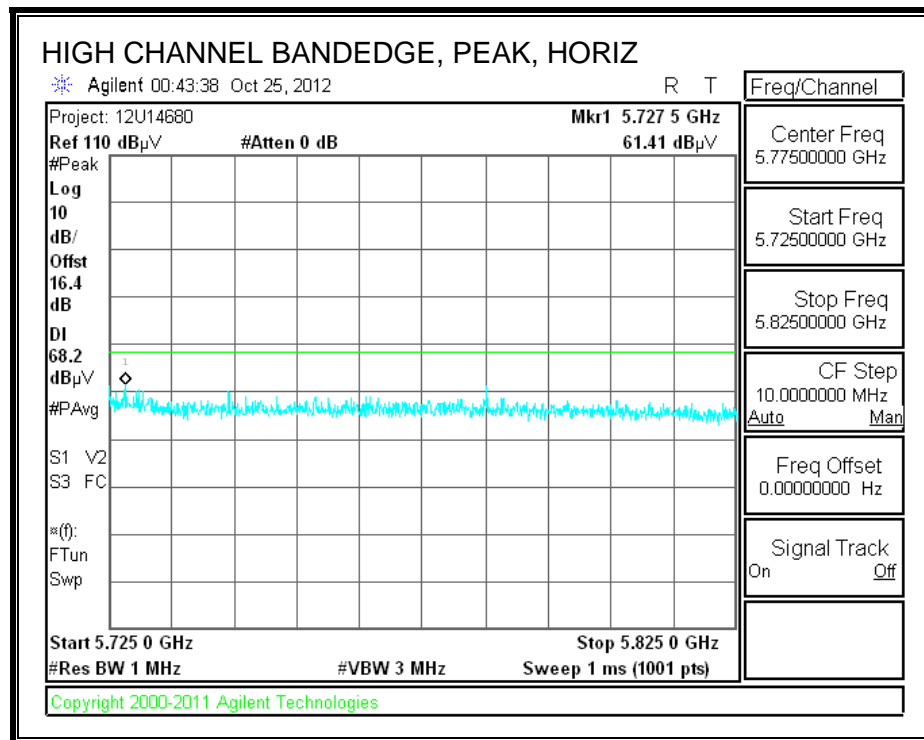


RESTRICTED & AUTHORIZED BANDEGE (LOW 2 CHANNEL)

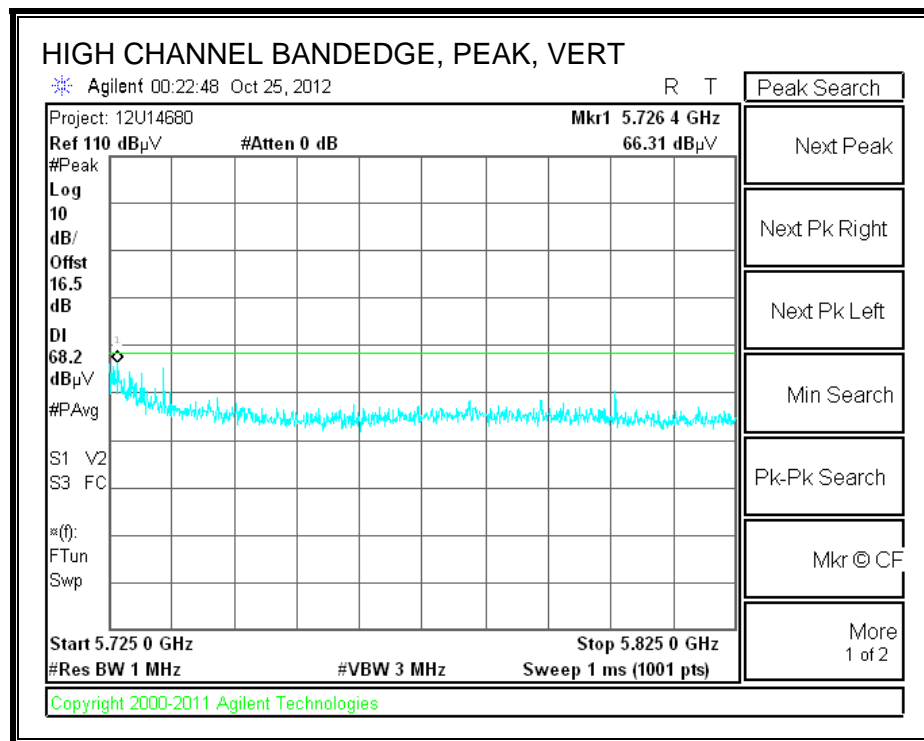
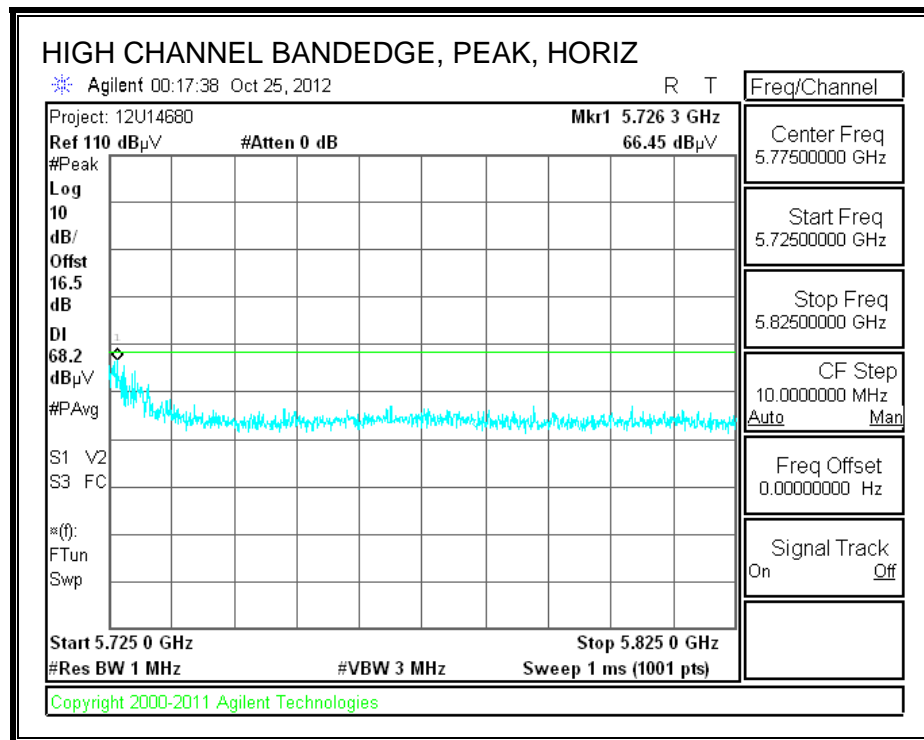




AUTHORIZED BANDEDGE (HIGH 1 CHANNEL)



AUTHORIZED BANDEDGE (HIGH 2 CHANNEL)



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 11/06/12
Project #: 12U14680
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11a TX 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

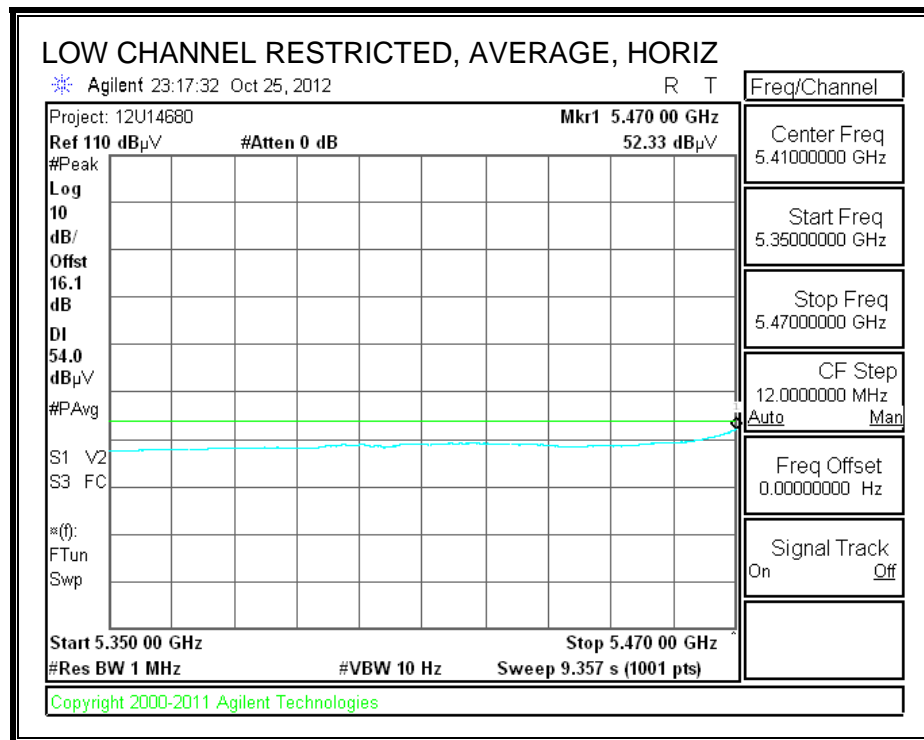
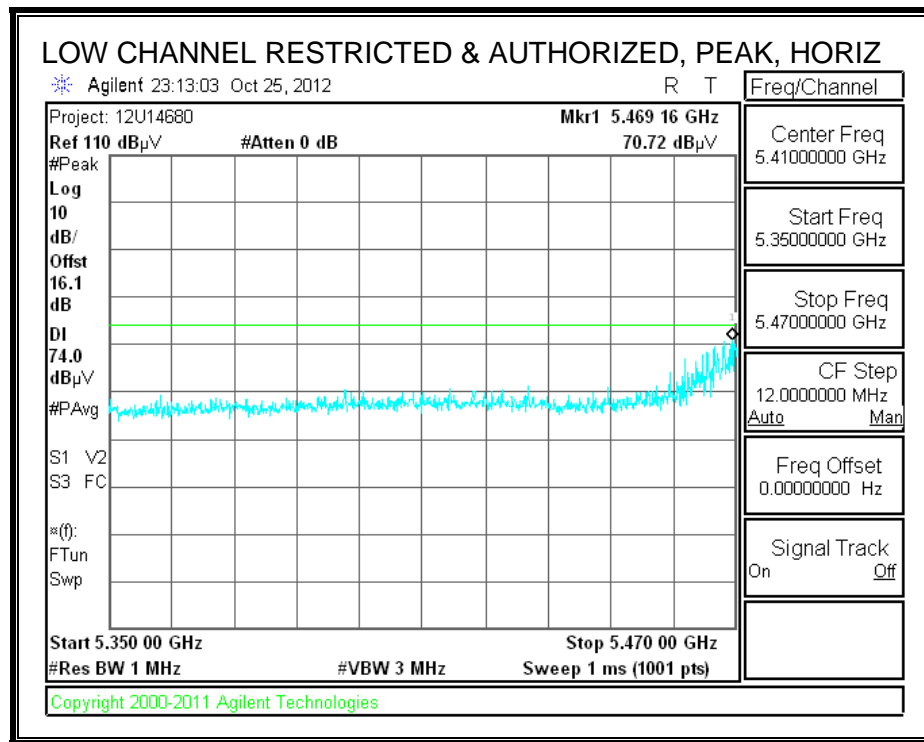
| f GHz | Dist (m) | Read dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Corr. dBuV/m | Limit dBuV/m | Margin dB | Ant. Pol. V/H | Det. P/A/Q/P | Notes |
|---------------------|-------------|--------------|------------|----------|-----------|--------------|------------|-----------------|-----------------|--------------|------------------|-----------------|-------|
| 5500 MHz 11a | | | | | | | | | | | | | |
| 11.000 | 3.0 | 34.8 | 38.4 | 10.5 | -33.6 | 0.0 | 0.7 | 50.8 | 74.0 | -23.2 | H | P | |
| 11.000 | 3.0 | 24.5 | 38.4 | 10.5 | -33.6 | 0.0 | 0.7 | 40.5 | 54.0 | -13.5 | H | A | |
| 11.000 | 3.0 | 35.3 | 38.4 | 10.5 | -33.6 | 0.0 | 0.7 | 51.3 | 74.0 | -22.7 | V | P | |
| 11.000 | 3.0 | 24.8 | 38.4 | 10.5 | -33.6 | 0.0 | 0.7 | 40.8 | 54.0 | -13.2 | V | A | |
| 5580 MHz 11a | | | | | | | | | | | | | |
| 11.160 | 3.0 | 34.5 | 38.5 | 10.7 | -33.4 | 0.0 | 0.7 | 51.0 | 74.0 | -23.0 | H | P | |
| 11.160 | 3.0 | 24.1 | 38.5 | 10.7 | -33.4 | 0.0 | 0.7 | 40.7 | 54.0 | -13.3 | H | A | |
| 11.160 | 3.0 | 37.0 | 38.5 | 10.7 | -33.4 | 0.0 | 0.7 | 53.6 | 74.0 | -20.4 | V | P | |
| 11.160 | 3.0 | 25.8 | 38.5 | 10.7 | -33.4 | 0.0 | 0.7 | 42.3 | 54.0 | -11.7 | V | A | |
| 5700 MHz 11a | | | | | | | | | | | | | |
| 11.400 | 3.0 | 35.7 | 38.8 | 11.1 | -33.2 | 0.0 | 0.7 | 53.1 | 74.0 | -20.9 | V | P | |
| 11.400 | 3.0 | 24.2 | 38.8 | 11.1 | -33.2 | 0.0 | 0.7 | 41.6 | 54.0 | -12.4 | V | A | |
| 11.400 | 3.0 | 33.9 | 38.8 | 11.1 | -33.2 | 0.0 | 0.7 | 51.3 | 74.0 | -22.7 | H | P | |
| 11.400 | 3.0 | 23.7 | 38.8 | 11.1 | -33.2 | 0.0 | 0.7 | 41.1 | 54.0 | -12.9 | H | A | |

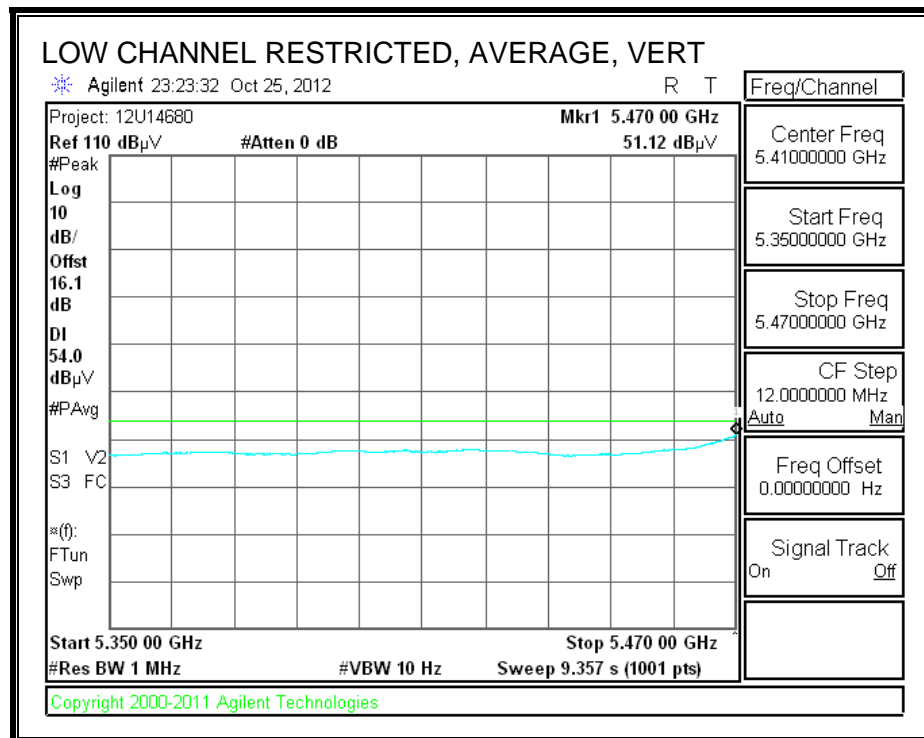
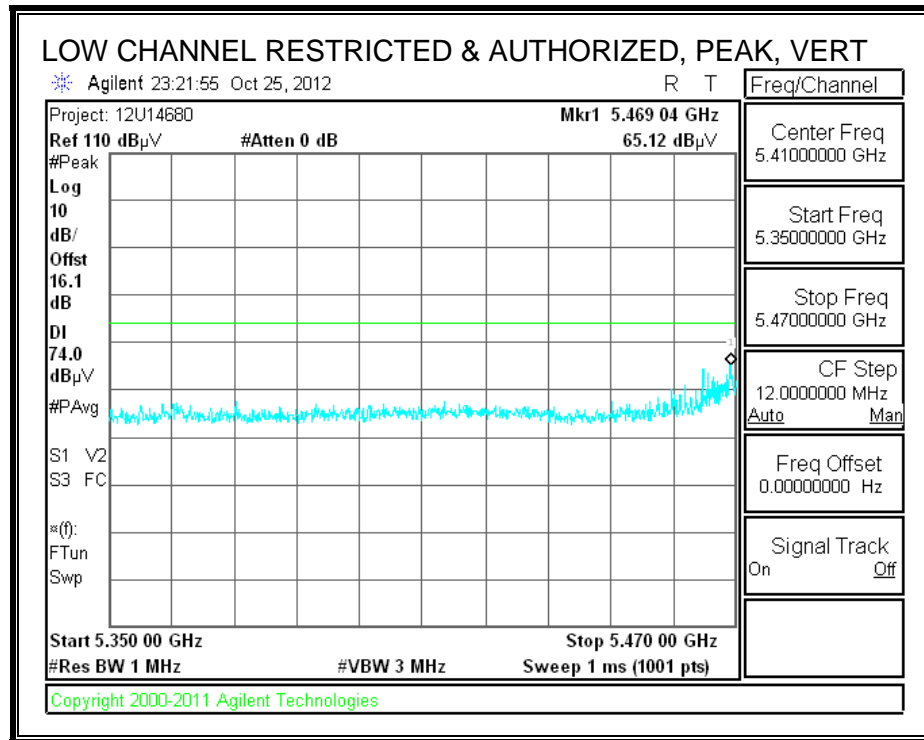
Rev. 4.1.2.7

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

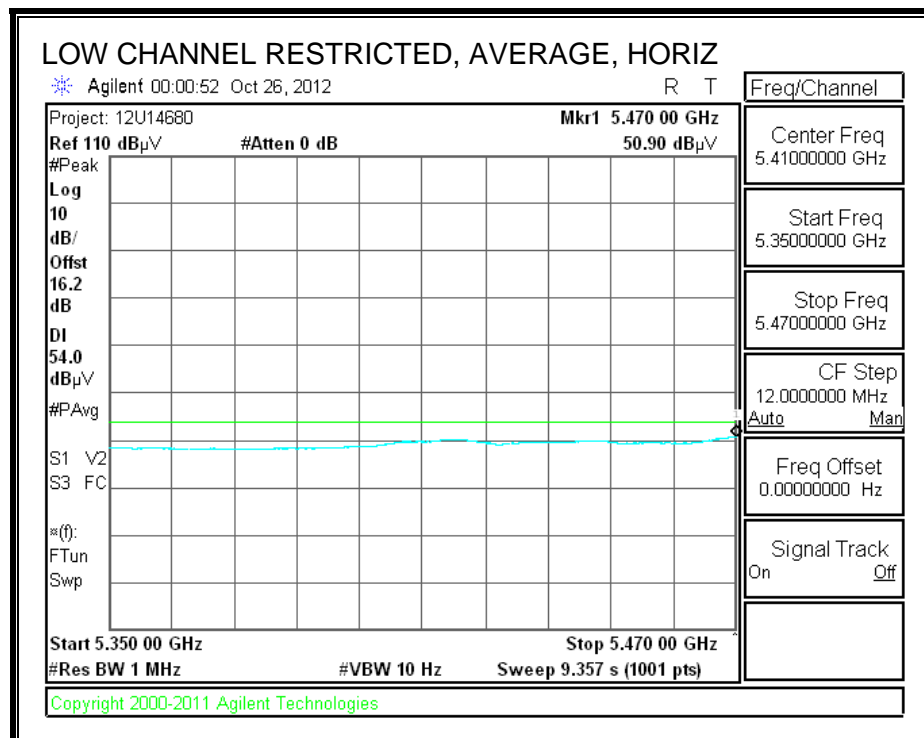
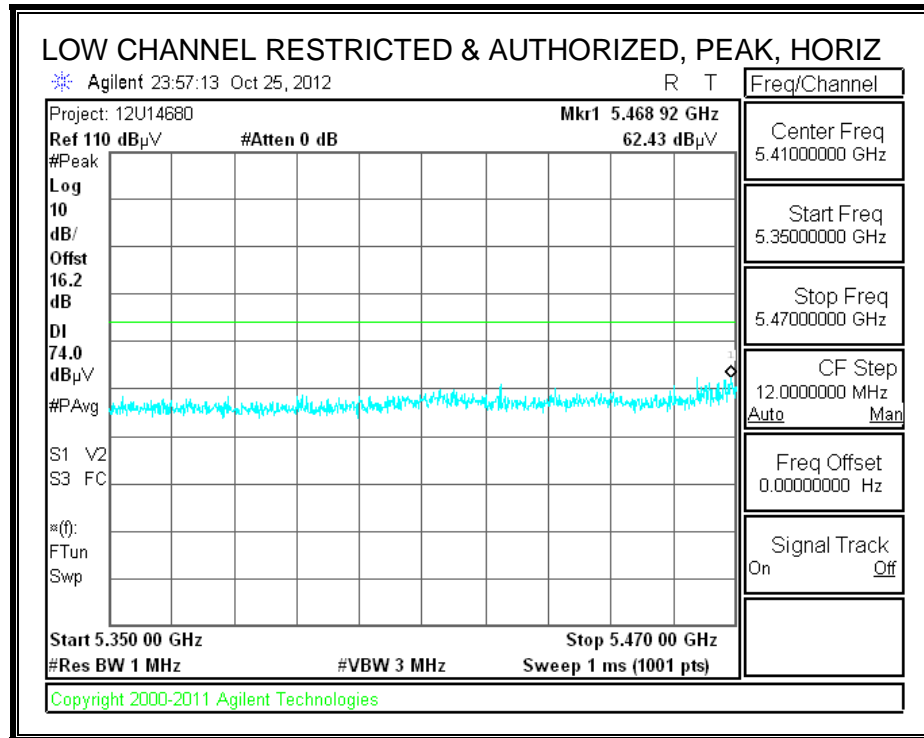
9.9. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.6 GHz BAND

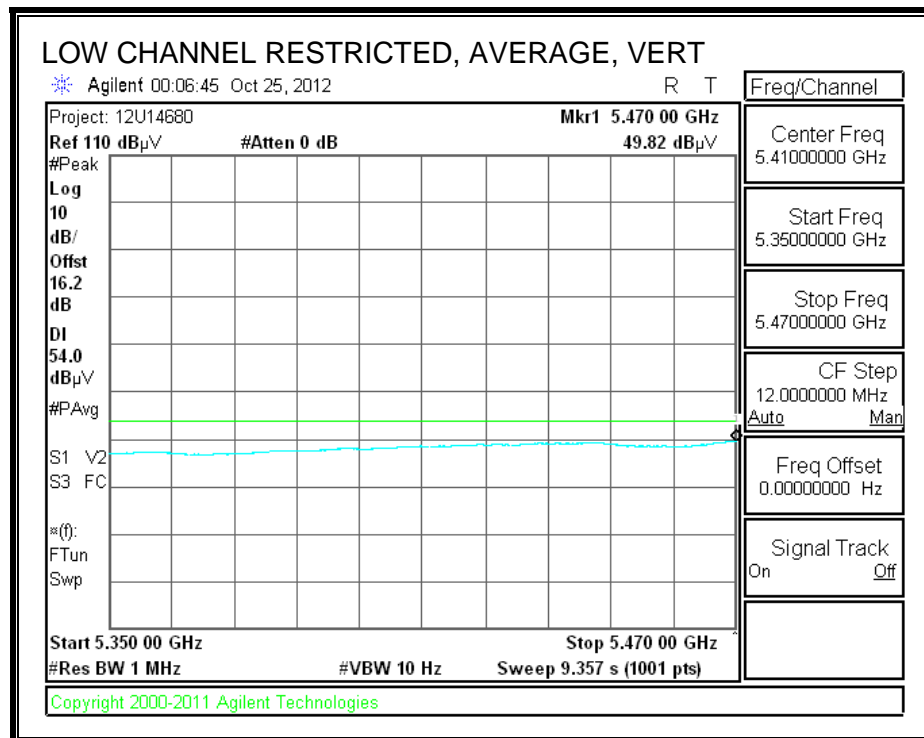
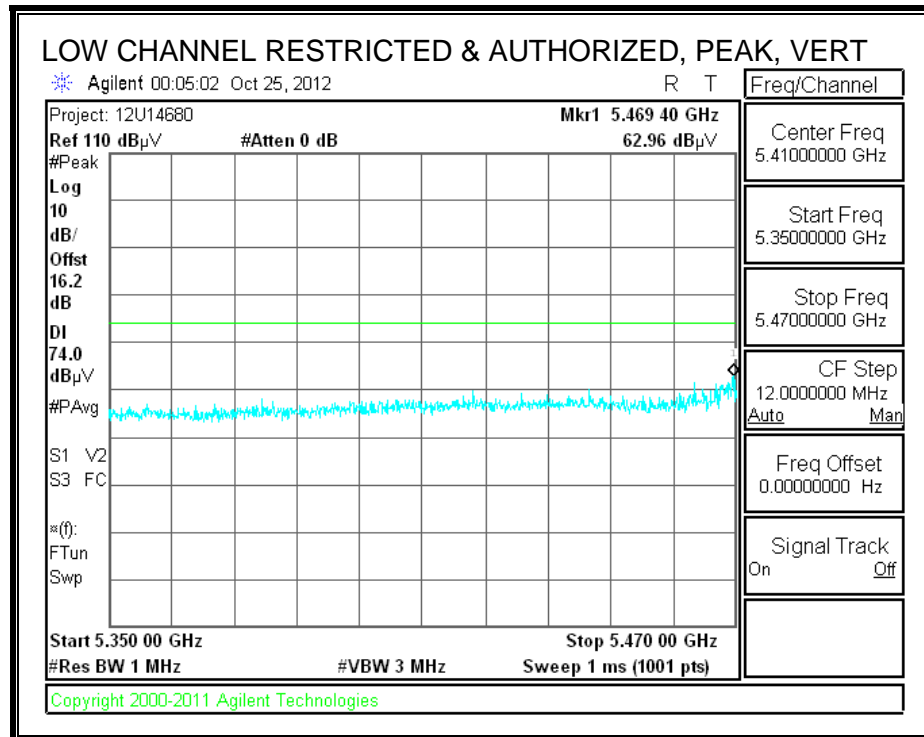
RESTRICTED & AUTHORIZED BANDEDGE (LOW 1 CHANNEL)



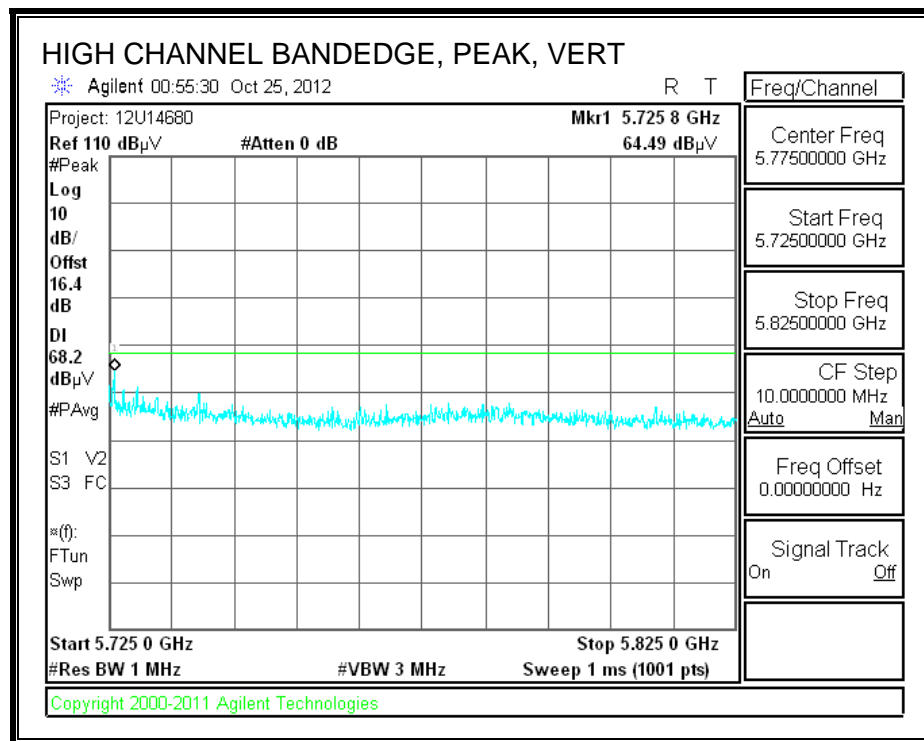
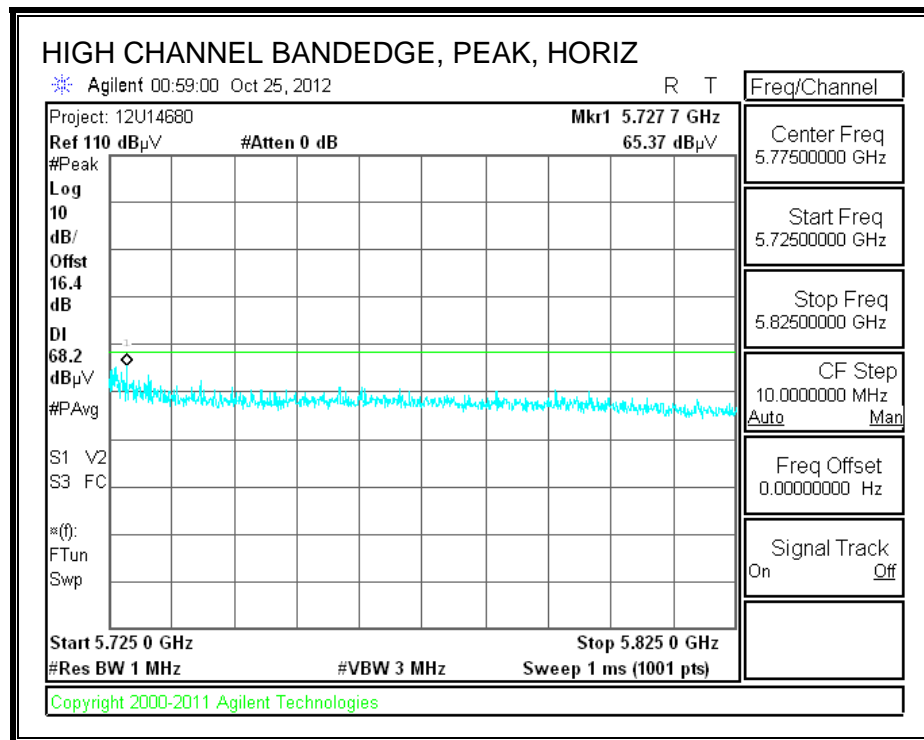


RESTRICTED & AUTHORIZED BANDEGE (LOW 2 CHANNEL)

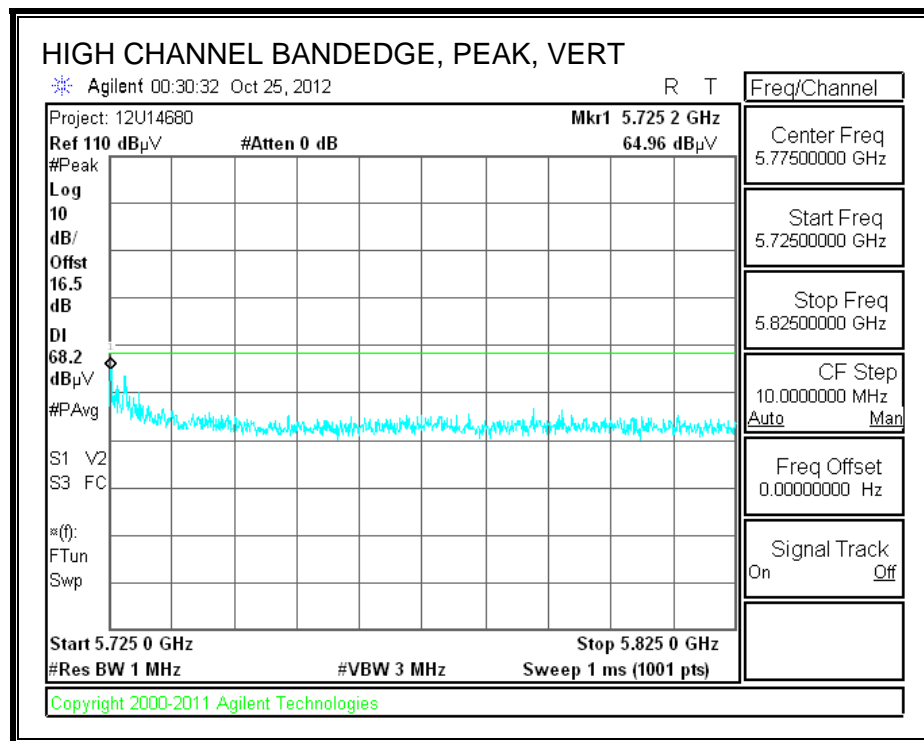
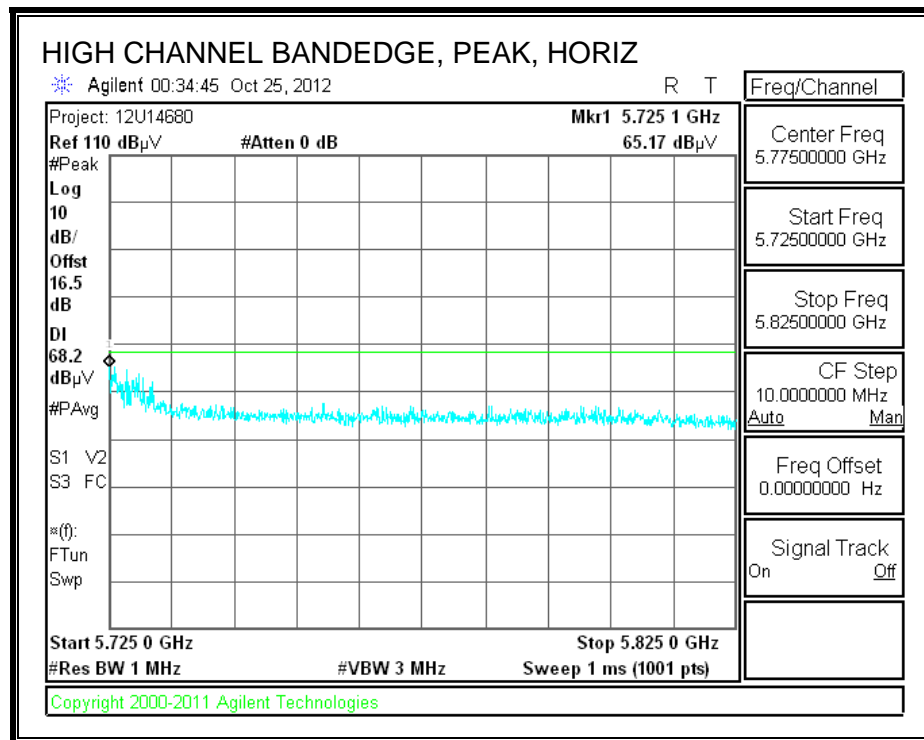




AUTHORIZED BANDEDGE (HIGH 1 CHANNEL)



AUTHORIZED BANDEDGE (HIGH 2 CHANNEL)



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 11/06/12
Project #: 12U14680
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11n HT20 TX 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

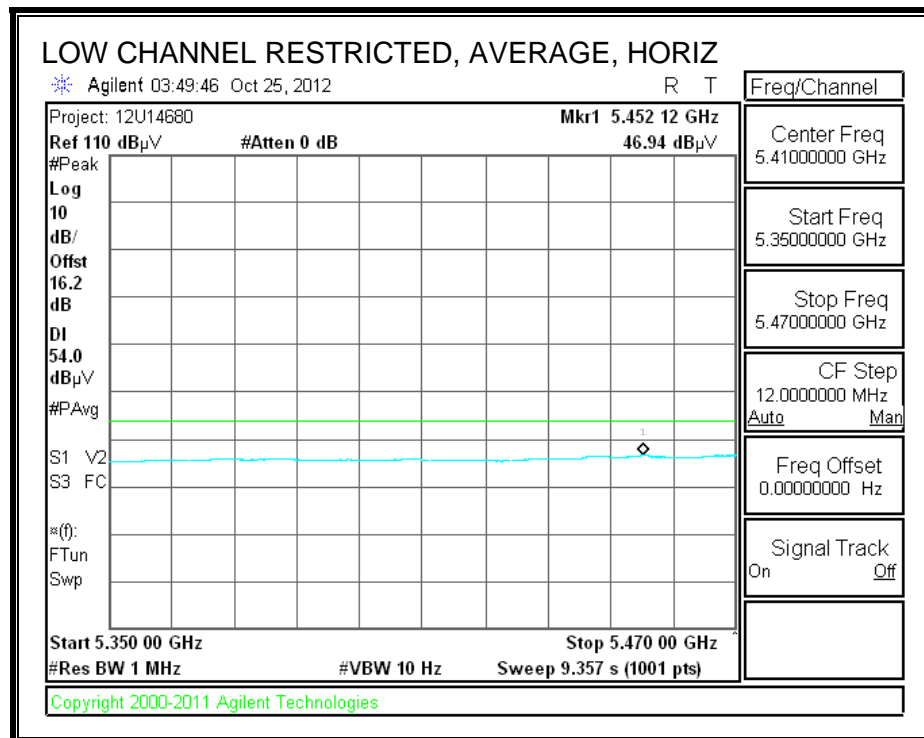
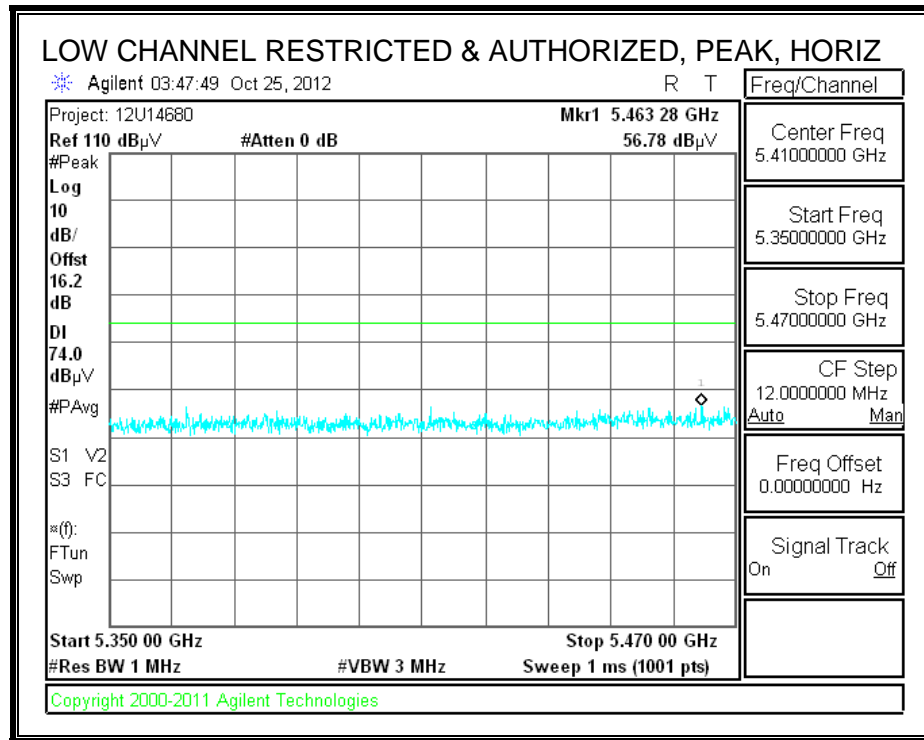
| f GHz | Dist (m) | Read dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Corr. dBuV/m | Limit dBuV/m | Margin dB | Ant. Pol. V/H | Det. P/A/Q/P | Notes |
|----------------------|-------------|--------------|------------|----------|-----------|--------------|------------|-----------------|-----------------|--------------|------------------|-----------------|-------|
| 5500 MHz HT20 | | | | | | | | | | | | | |
| 11.000 | 3.0 | 34.1 | 38.4 | 10.5 | -33.6 | 0.0 | 0.7 | 50.2 | 74.0 | -23.8 | H | P | |
| 11.000 | 3.0 | 24.3 | 38.4 | 10.5 | -33.6 | 0.0 | 0.7 | 40.4 | 54.0 | -13.6 | H | A | |
| 11.000 | 3.0 | 35.3 | 38.4 | 10.5 | -33.6 | 0.0 | 0.7 | 51.4 | 74.0 | -22.6 | V | P | |
| 11.000 | 3.0 | 25.5 | 38.4 | 10.5 | -33.6 | 0.0 | 0.7 | 41.6 | 54.0 | -12.4 | V | A | |
| 5580 MHz HT20 | | | | | | | | | | | | | |
| 11.160 | 3.0 | 34.4 | 38.5 | 10.7 | -33.4 | 0.0 | 0.7 | 50.9 | 74.0 | -23.1 | H | P | |
| 11.160 | 3.0 | 24.0 | 38.5 | 10.7 | -33.4 | 0.0 | 0.7 | 40.6 | 54.0 | -13.4 | H | A | |
| 11.160 | 3.0 | 35.2 | 38.5 | 10.7 | -33.4 | 0.0 | 0.7 | 51.8 | 74.0 | -22.2 | V | P | |
| 11.160 | 3.0 | 25.4 | 38.5 | 10.7 | -33.4 | 0.0 | 0.7 | 42.0 | 54.0 | -12.1 | V | A | |
| 5700 MHz HT20 | | | | | | | | | | | | | |
| 11.400 | 3.0 | 34.0 | 38.8 | 11.1 | -33.2 | 0.0 | 0.7 | 51.4 | 74.0 | -22.6 | H | P | |
| 11.400 | 3.0 | 23.7 | 38.8 | 11.1 | -33.2 | 0.0 | 0.7 | 41.1 | 54.0 | -12.9 | H | A | |
| 11.400 | 3.0 | 34.7 | 38.8 | 11.1 | -33.2 | 0.0 | 0.7 | 52.1 | 74.0 | -21.9 | V | P | |
| 11.400 | 3.0 | 23.9 | 38.8 | 11.1 | -33.2 | 0.0 | 0.7 | 41.3 | 54.0 | -12.7 | V | A | |

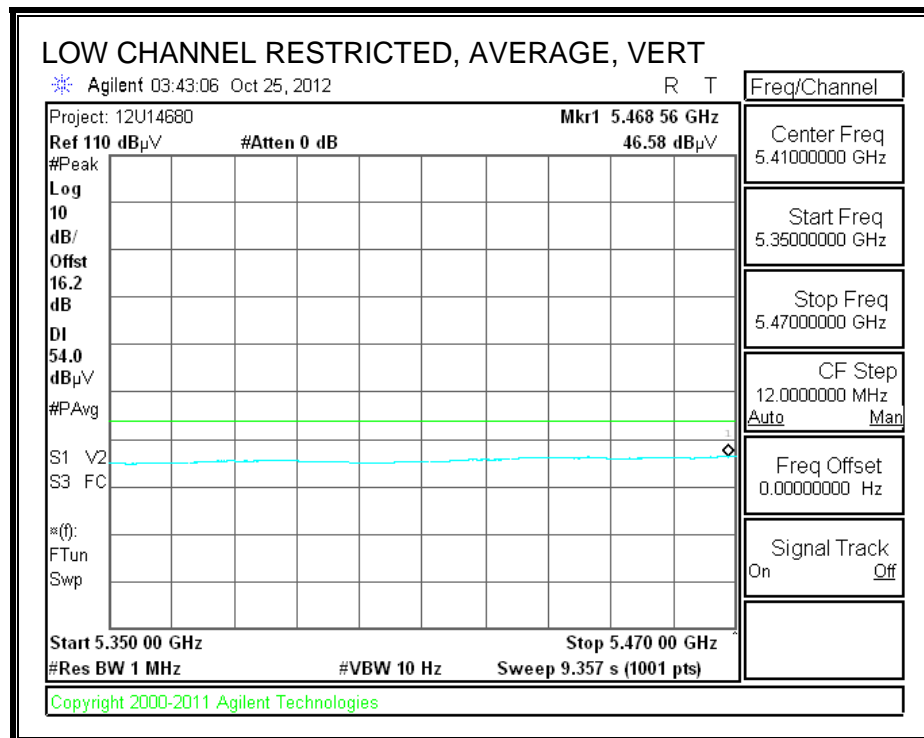
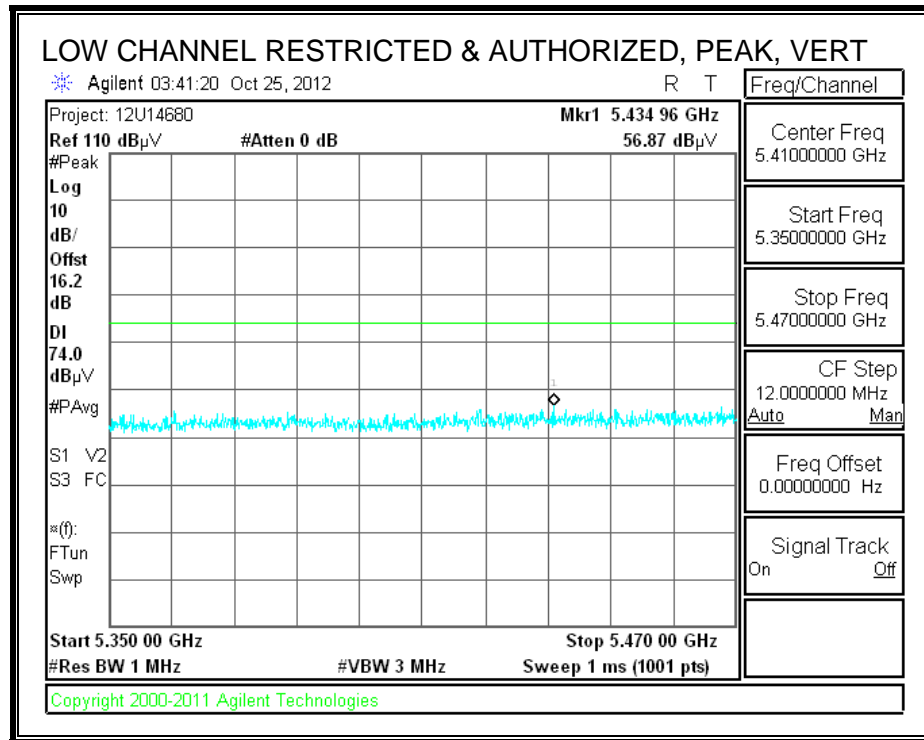
Rev. 4.1.2.7

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

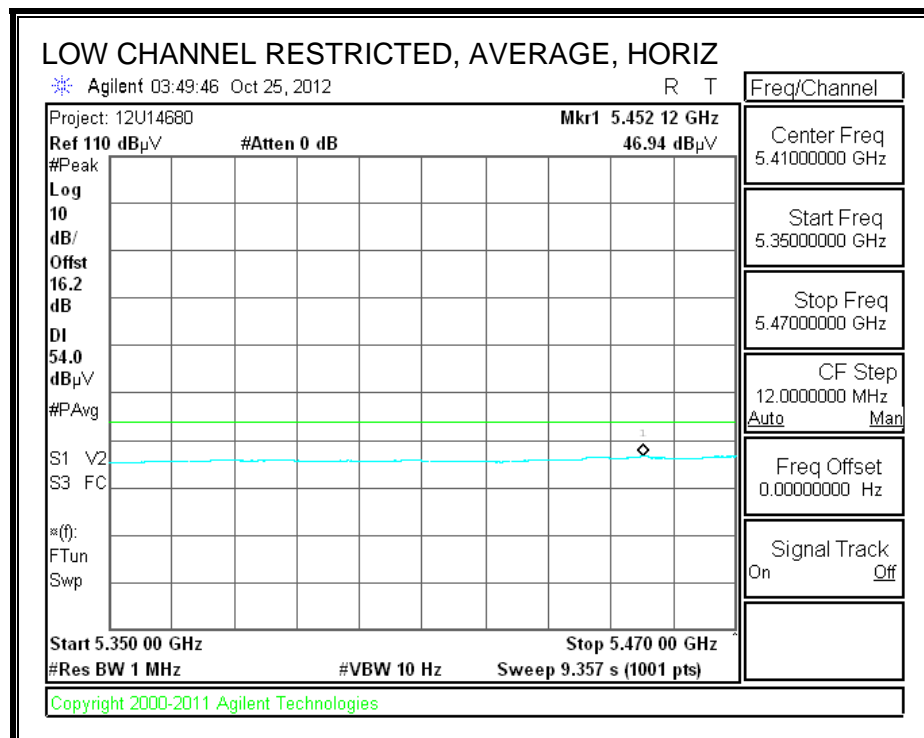
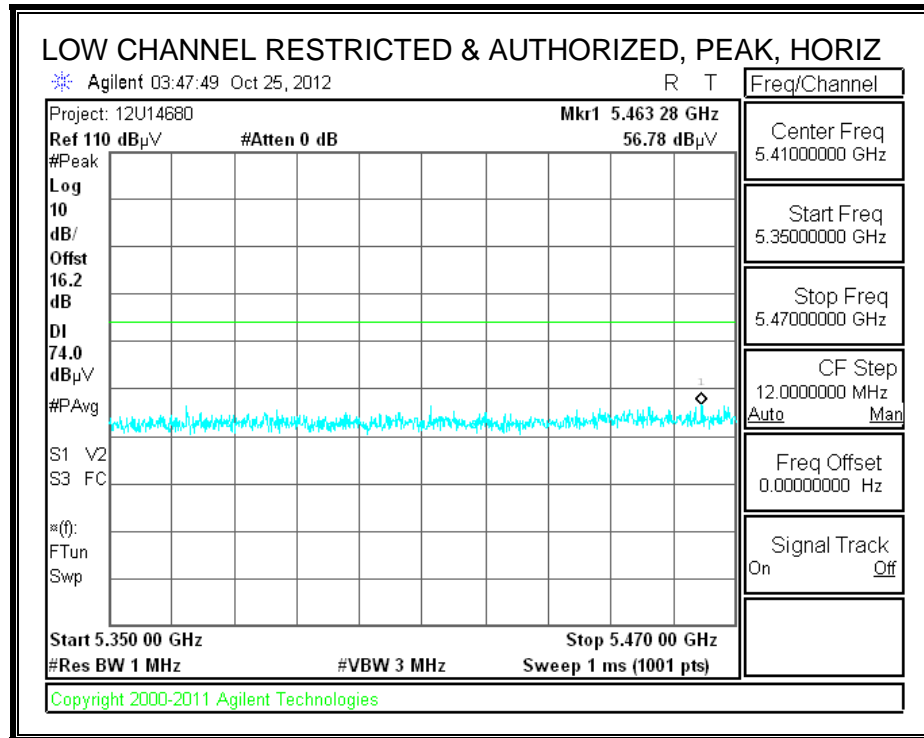
9.10. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.6 GHz BAND

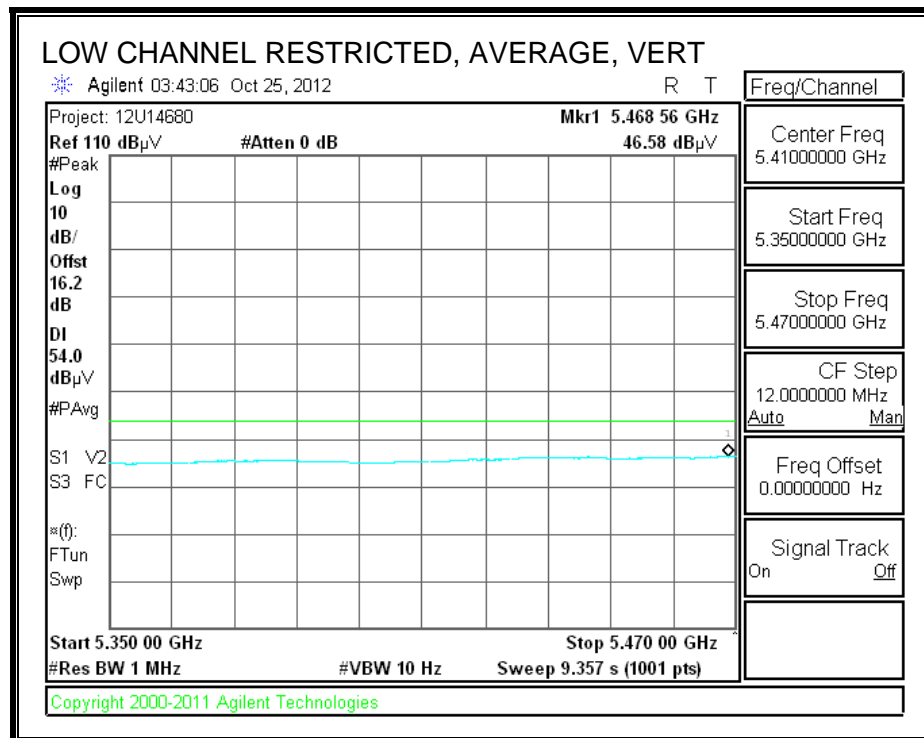
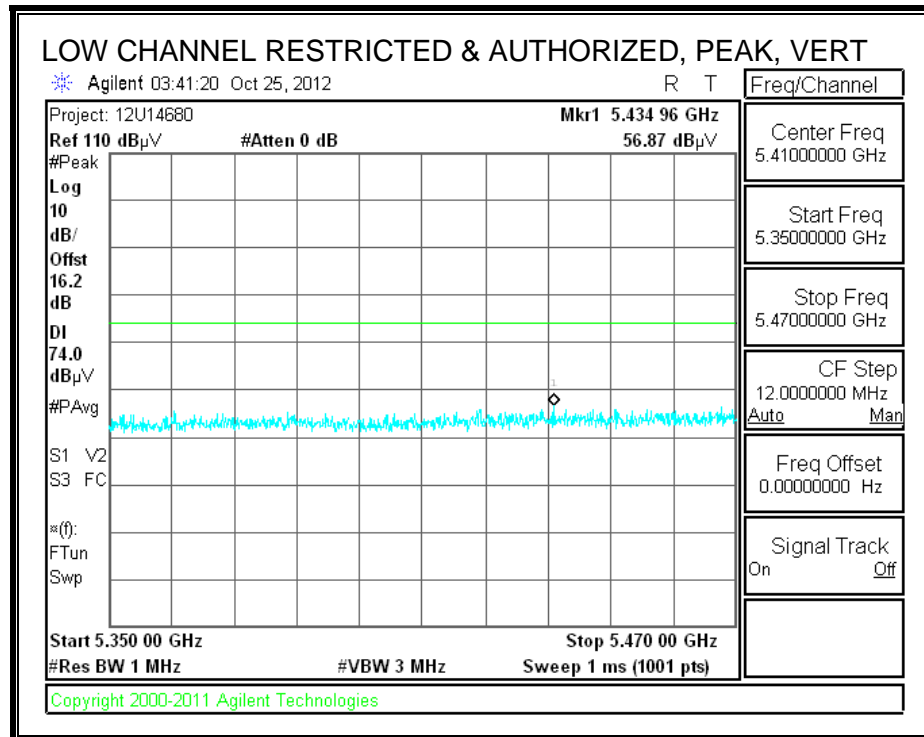
RESTRICTED & AUTHORIZED BANDEDGE (LOW 1 CHANNEL)



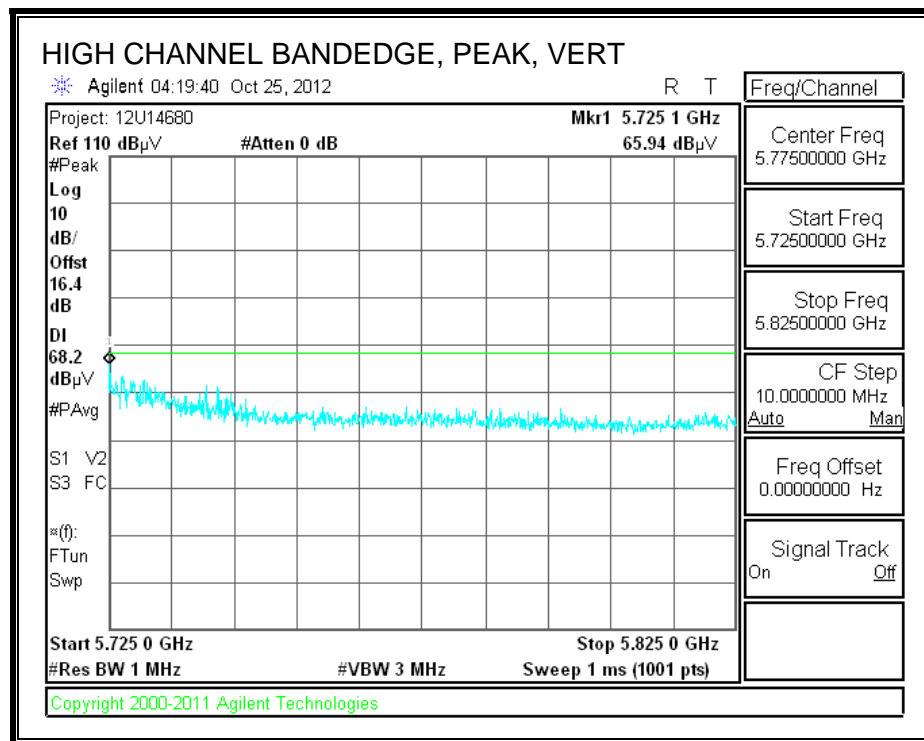
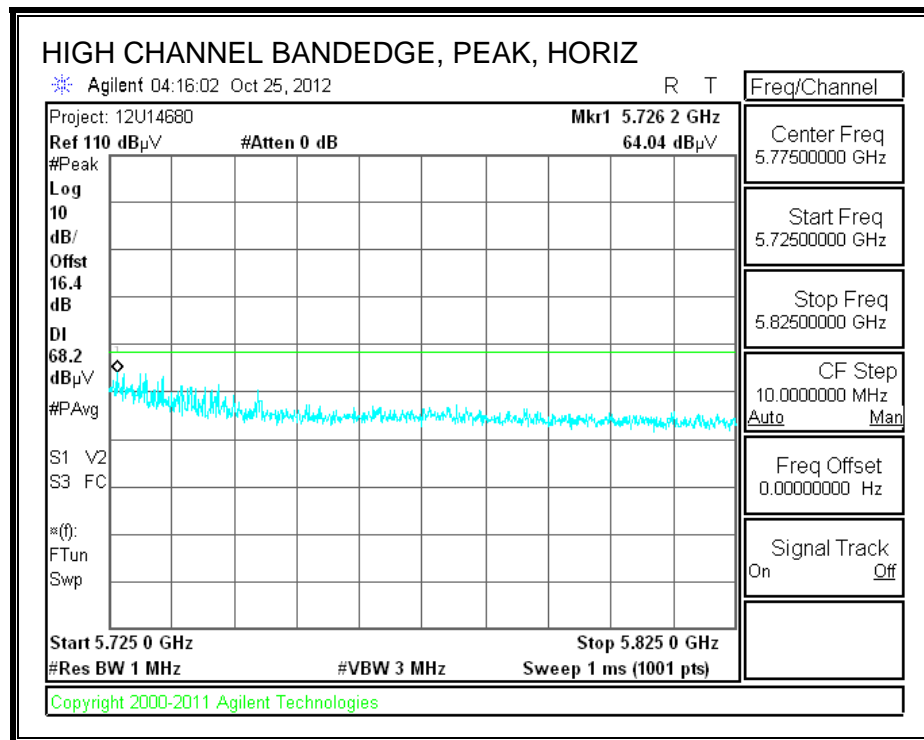


RESTRICTED & AUTHORIZED BANDEGE (LOW 2 CHANNEL)





AUTHORIZED BANDEDGE (HIGH CHANNEL)



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 11/06/12
Project #: 12U14680
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11n HT40 TX 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

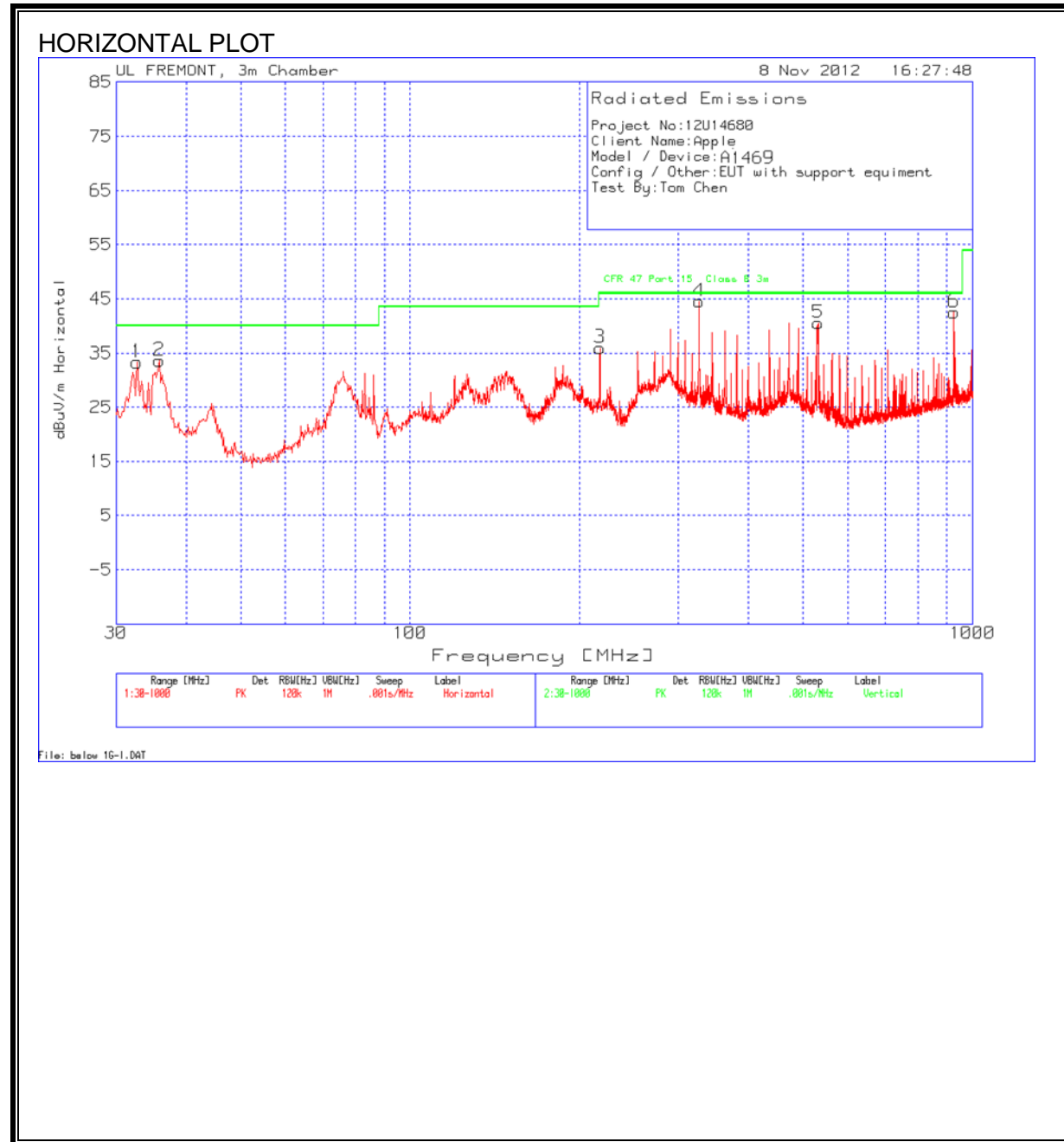
| f GHz | Dist (m) | Read dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Corr. dBuV/m | Limit dBuV/m | Margin dB | Ant. Pol. V/H | Det. P/A/Q/P | Notes |
|---------------------|-------------|--------------|------------|----------|-----------|--------------|------------|-----------------|-----------------|--------------|------------------|-----------------|-------|
| 5510MHz HT40 | | | | | | | | | | | | | |
| 11.020 | 3.0 | 35.0 | 38.4 | 10.5 | -33.6 | 0.0 | 0.7 | 51.0 | 74.0 | -23.0 | H | P | |
| 11.020 | 3.0 | 24.3 | 38.4 | 10.5 | -33.6 | 0.0 | 0.7 | 40.4 | 54.0 | -13.6 | H | A | |
| 11.020 | 3.0 | 34.5 | 38.4 | 10.5 | -33.6 | 0.0 | 0.7 | 50.6 | 74.0 | -23.4 | V | P | |
| 11.020 | 3.0 | 24.3 | 38.4 | 10.5 | -33.6 | 0.0 | 0.7 | 40.4 | 54.0 | -13.6 | V | A | |
| 5550MHz HT40 | | | | | | | | | | | | | |
| 11.100 | 3.0 | 35.2 | 38.5 | 10.6 | -33.5 | 0.0 | 0.7 | 51.5 | 74.0 | -22.5 | H | P | |
| 11.100 | 3.0 | 24.2 | 38.5 | 10.6 | -33.5 | 0.0 | 0.7 | 40.6 | 54.0 | -13.4 | H | A | |
| 11.100 | 3.0 | 35.3 | 38.5 | 10.6 | -33.5 | 0.0 | 0.7 | 51.6 | 74.0 | -22.4 | V | P | |
| 11.100 | 3.0 | 24.3 | 38.5 | 10.6 | -33.5 | 0.0 | 0.7 | 40.6 | 54.0 | -13.4 | V | A | |
| 5670MHz HT40 | | | | | | | | | | | | | |
| 11.340 | 3.0 | 33.8 | 38.7 | 11.0 | -33.2 | 0.0 | 0.7 | 51.0 | 74.0 | -23.0 | H | P | |
| 11.340 | 3.0 | 23.8 | 38.7 | 11.0 | -33.2 | 0.0 | 0.7 | 41.0 | 54.0 | -13.0 | H | A | |
| 11.340 | 3.0 | 34.0 | 38.7 | 11.0 | -33.2 | 0.0 | 0.7 | 51.1 | 74.0 | -22.9 | V | P | |
| 11.340 | 3.0 | 23.7 | 38.7 | 11.0 | -33.2 | 0.0 | 0.7 | 40.9 | 54.0 | -13.1 | V | A | |

Rev. 4.1.2.7

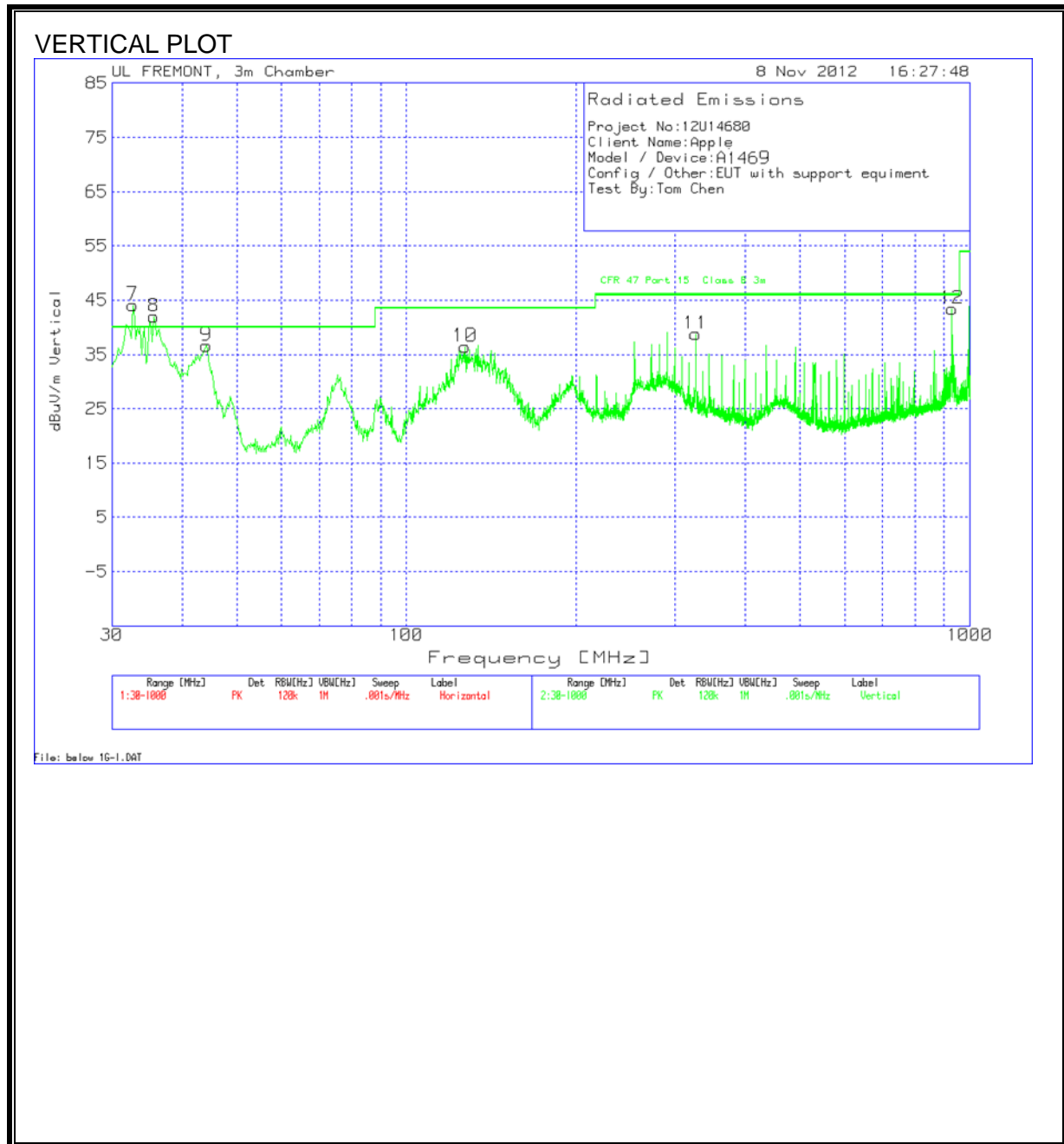
Note: No other emissions were detected above the system noise floor.

9.11. WORST-CASE BELOW 1 GHz

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



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



HORIZONTAL AND VERTICAL DATA

Project No:12U14680
Client Name:Apple
Model / Device:A1469
Config / Other:EUT with support equipment
Test By:Tom Chen

Horizontal 30 - 1000MHz

| Marker No. | Test Frequency | Meter Reading | Detector | 25MHz-1GHz Chambr 3m Amplified (dB) | Antenna T185 (dB) | dBuV/m | CFR 47 Part 15 Class B 3m | Margin | Polarity |
|------------|----------------|---------------|----------|-------------------------------------|-------------------|--------|---------------------------|--------|----------|
| 1 | 32.7138 | 41.61 | PK | -27.5 | 19.2 | 33.31 | 40 | -6.69 | Horz |
| 2 | 35.8153 | 44.09 | PK | -27.4 | 16.9 | 33.59 | 40 | -6.41 | Horz |
| 3 | 217.6419 | 51.04 | PK | -25.7 | 10.6 | 35.94 | 46 | -10.06 | Horz |
| 4 | 326.5614 | 48.28 | QP | -25.3 | 13.8 | 36.78 | 46 | -9.22 | Horz |
| 5 | 531.8645 | 48.34 | PK | -25.8 | 18 | 40.54 | 46 | -5.46 | Horz |
| 6 | 926.5328 | 44.17 | PK | -23.9 | 22.3 | 42.57 | 46 | -3.43 | Horz |

Vertical 30 - 1000MHz

| Marker No. | Test Frequency | Meter Reading | Detector | 25MHz-1GHz Chambr 3m Amplified (dB) | Antenna T185 (dB) | dBuV/m | CFR 47 Part 15 Class B 3m | Margin | Polarity |
|------------|----------------|---------------|----------|-------------------------------------|-------------------|--------|---------------------------|--------|----------|
| 7 | 32.605 | 41.11 | QP | -27.5 | 19.3 | 32.91 | 40 | -7.09 | Vert |
| 8 | 35.6874 | 42.96 | QP | -27.4 | 17 | 32.56 | 40 | -7.44 | Vert |
| 9 | 44.1507 | 53.22 | PK | -27.4 | 10.8 | 36.62 | 40 | -3.38 | Vert |
| 10 | 127.1163 | 49.04 | PK | -26.5 | 13.9 | 36.44 | 43.5 | -7.06 | Vert |
| 11 | 326.3889 | 50.29 | PK | -25.3 | 13.8 | 38.79 | 46 | -7.21 | Vert |
| 12 | 930.2158 | 23.25 | QP | -23.8 | 22.4 | 21.85 | 46 | -24.15 | Vert |

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

| Frequency of Emission (MHz) | Conducted Limit (dB μ V) | |
|-----------------------------|------------------------------|------------|
| | 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

Project No:12U14680

Client Name:Apple

Model/Device:A1469

Test Volt/Freq:120 VAC / 60Hz

Test By:Tom Chen

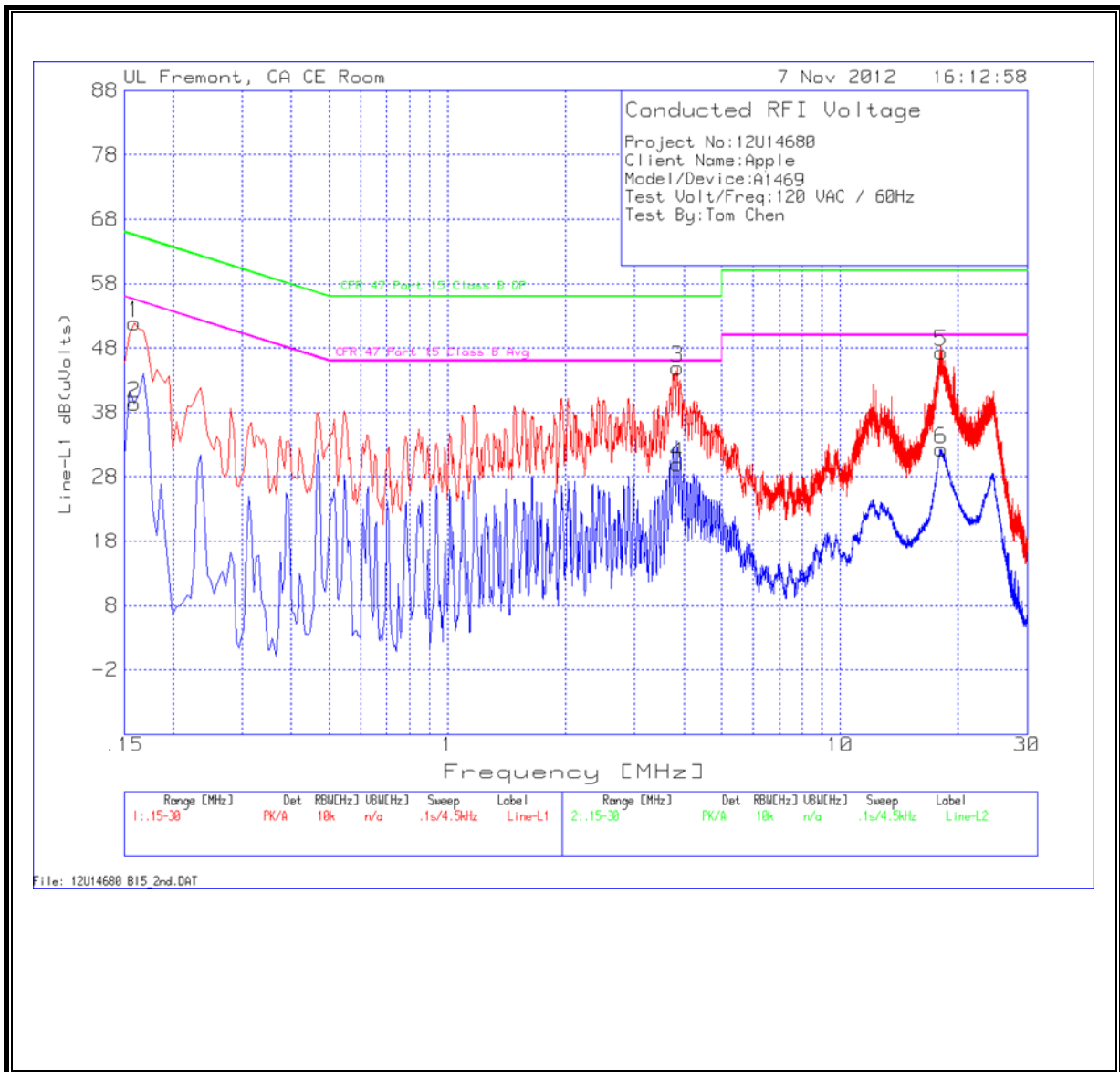
Line-L1 .15 - 30MHz

| Test Frequency | Meter Reading | Detector | T24 IL L1.TXT (dB) | LC Cables 1&3.TXT (dB) | dB(uVolts) | CFR 47 Part 15 Class B QP | Margin | CFR 47 Part 15 Class B Avg | Margin |
|----------------|---------------|----------|--------------------|------------------------|------------|---------------------------|--------|----------------------------|--------|
| 0.159 | 51.79 | PK | 0.1 | 0 | 51.89 | 65.5 | -13.61 | - | - |
| 0.159 | 39.33 | Av | 0.1 | 0 | 39.43 | - | - | 55.5 | -16.07 |
| 3.8535 | 44.69 | PK | 0.1 | 0.1 | 44.89 | 56 | -11.11 | - | - |
| 3.8535 | 29.82 | Av | 0.1 | 0.1 | 30.02 | - | - | 46 | -15.98 |
| 18.1185 | 46.96 | PK | 0.2 | 0.2 | 47.36 | 60 | -12.64 | - | - |
| 18.1185 | 31.87 | Av | 0.2 | 0.2 | 32.27 | - | - | 50 | -17.73 |

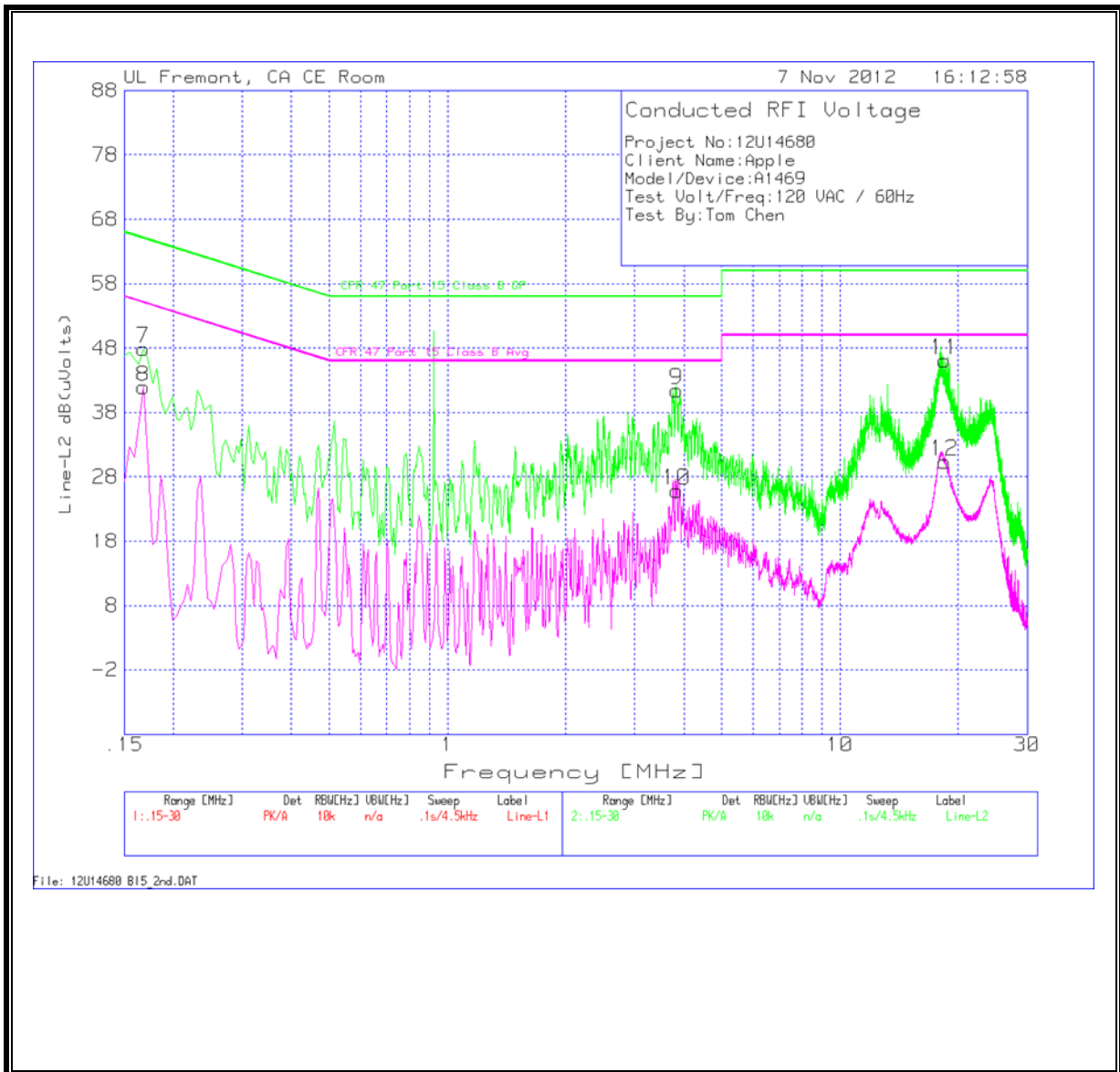
Line-L2 .15 - 30MHz

| Test Frequency | Meter Reading | Detector | T24 IL L2.TXT (dB) | LC Cables 2&3.TXT (dB) | dB(uVolts) | CFR 47 Part 15 Class B QP | Margin | CFR 47 Part 15 Class B Avg | Margin |
|----------------|---------------|----------|--------------------|------------------------|------------|---------------------------|--------|----------------------------|--------|
| 0.168 | 47.8 | PK | 0.1 | 0 | 47.9 | 65.1 | -17.2 | - | - |
| 0.168 | 41.81 | Av | 0.1 | 0 | 41.91 | - | - | 55.1 | -13.19 |
| 3.8355 | 41.28 | PK | 0.1 | 0.1 | 41.48 | 56 | -14.52 | - | - |
| 3.8355 | 25.71 | Av | 0.1 | 0.1 | 25.91 | - | - | 46 | -20.09 |
| 18.4605 | 45.65 | PK | 0.2 | 0.2 | 46.05 | 60 | -13.95 | - | - |
| 18.4605 | 30.02 | Av | 0.2 | 0.2 | 30.42 | - | - | 50 | -19.58 |

LINE 1 RESULTS



LINE 2 RESULTS



11. DYNAMIC FREQUENCY SELECTION

11.1. OVERVIEW

11.1.1. LIMITS

FCC

§15.407 (h) and FCC 06-96 APPENDIX "COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVICES 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 |
| <p>Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna</p> <p>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.</p> | |

Table 4: DFS Response requirement values

| Parameter | Value |
|--|---|
| <i>Non-occupancy period</i> | 30 minutes |
| <i>Channel Availability Check Time</i> | 60 seconds |
| <i>Channel Move Time</i> | 10 seconds |
| <i>Channel Closing Transmission Time</i> | 200 milliseconds + approx. 60 milliseconds over remaining 10 second period |
| <p>The instant that the <i>Channel Move Time</i> and the <i>Channel Closing Transmission Time</i> begins is as follows:</p> <p>For the Short pulse radar Test Signals this instant is the end of the <i>Burst</i>.</p> <p>For the Frequency Hopping radar Test Signal, this instant is the end of the last radar burst generated.</p> <p>For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission.</p> <p>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.</p> | |

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

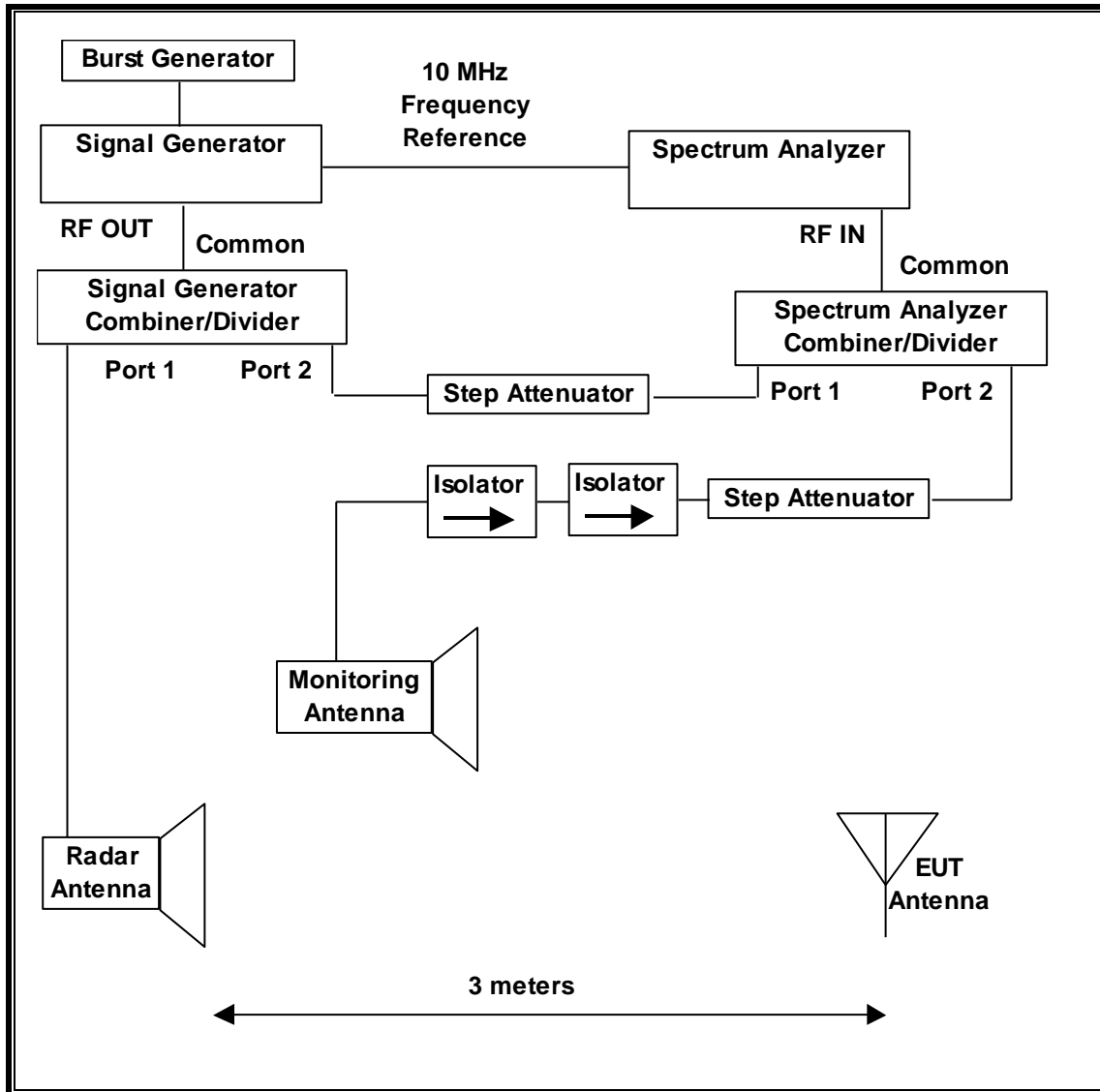
| Radar Waveform | Bursts | Pulses per Burst | Pulse Width (μsec) | Chirp Width (MHz) | PRI (μsec) | Minimum Percentage of Successful Detection | Minimum Trials |
|----------------|--------|------------------|--------------------|-------------------|------------|--|----------------|
| 5 | 8-20 | 1-3 | 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 |

11.1.2. 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 Frequency 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. 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. The Reference Level Offset of the spectrum analyzer is adjusted so that the displayed amplitude of the signal is –64 dBm.

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

A link is established between the Master and Slave and the distance between the units is adjusted as needed to provide a suitable received level at the Master and Slave devices. The video test file is streamed to generate WLAN traffic. The monitoring antenna is adjusted so that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold.

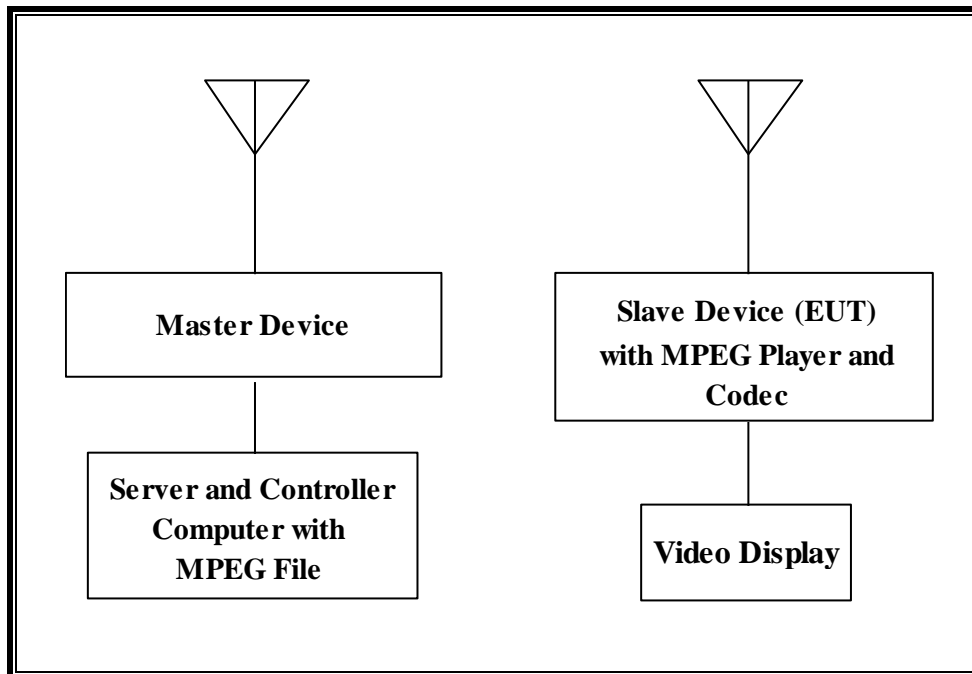
TEST AND MEASUREMENT EQUIPMENT

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

| TEST EQUIPMENT LIST | | | | |
|--------------------------------|--------------|--------|--------------|----------|
| Description | Manufacturer | Model | Asset Number | Cal Due |
| Spectrum Analyzer, 26.5 GHz | Agilent / HP | E4440A | C01178 | 08/18/13 |
| Vector Signal Generator, 20GHz | Agilent / HP | E8267C | C01066 | 11/17/12 |

11.1.3. SETUP OF EUT (CLIENT MODE)

RADIATED METHOD EUT TEST SETUP



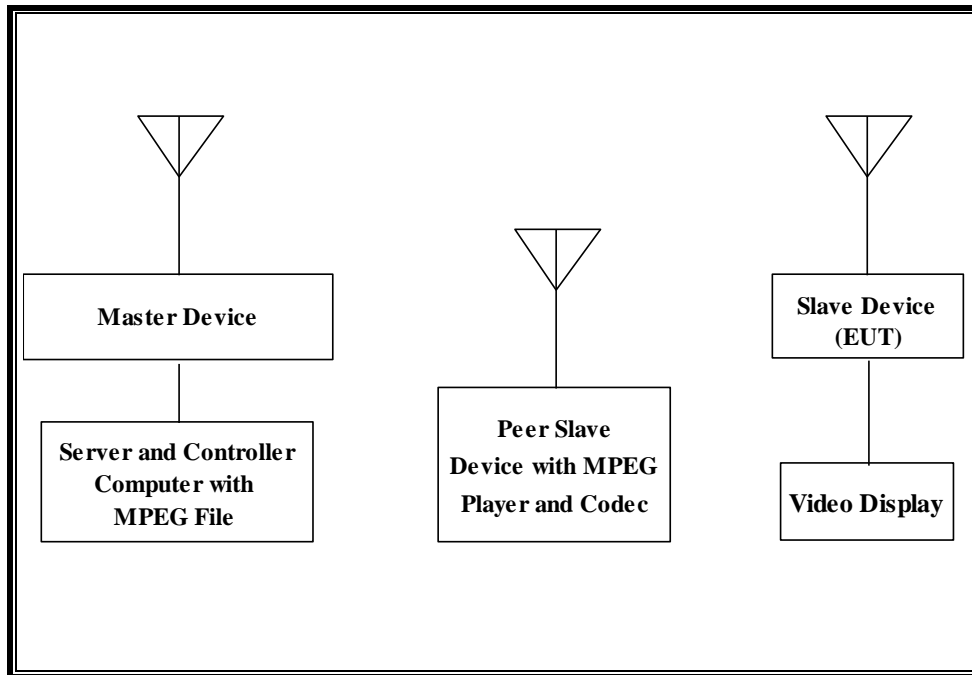
SUPPORT EQUIPMENT

The following support equipment was utilized for the DFS tests documented in this report:

| PERIPHERAL SUPPORT EQUIPMENT LIST | | | | |
|---------------------------------------|-------------------|-------------------|---------------|-----------|
| Description | Manufacturer | Model | Serial Number | FCC ID |
| Wireless Access Point (Master Device) | Cisco | AIR-AP1252AG-A-K9 | FTX130390D9 | LDK102061 |
| AC Adapter (AP) | Delta Electronics | EADP-45BB B | DTH1049902N | DoC |
| Notebook PC (Controller/Server) | Apple | MacBook Pro A1150 | AOU257941 | DoC |
| AC Adapter (Controller/Server) | Delta Electronics | A1344 | MV05104CNAL1A | DoC |

11.1.4. SETUP OF EUT (CLIENT-TO-CLIENT COMMUNICATIONS MODE)

RADIATED METHOD EUT TEST SETUP



SUPPORT EQUIPMENT

The following support equipment was utilized for the DFS tests documented in this report:

| PERIPHERAL SUPPORT EQUIPMENT LIST | | | | |
|---------------------------------------|-------------------|-------------------|--------------------------|-----------|
| Description | Manufacturer | Model | Serial Number | FCC ID |
| Wireless Access Point (Master Device) | Cisco | AIR-AP1252AG-A-K9 | FTX130390D9 | LDK102061 |
| AC Adapter (AP) | Delta Electronics | EADP-45BB B | DTH1049902N | DoC |
| Notebook PC (Controller/Server) | Apple | MacBook Pro A1150 | AOU257941 | DoC |
| AC Adapter (Controller PC) | Delta Electronics | A1344 | MV05104CNAL1A | DoC |
| Tablet PC (Peer Slave) | Apple | A1460 | DLXJ908HF8LD | BCGA1460 |
| Video Display Monitor | Dell | U2410F | CN-0F525M-72872-1B5-AGAL | DoC |

11.1.5. DESCRIPTION OF EUT

The EUT operates over the 5250-5350 MHz and 5470-5725 MHz ranges.

The EUT is a Slave Device without Radar Detection.

The highest power level within these bands is 22.87 dBm EIRP in the 5250-5350 MHz band and 22.78 dBm EIRP in the 5470-5725 MHz band.

The only antenna assembly utilized with the EUT has a gain of 3.16 dBi in the 5250-5350 MHz band and 2.34 dBi in the 5470-5725 MHz band.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is -64 dBm. After correction for procedural adjustments, the required radiated threshold at the antenna port 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.

The EUT uses one transmitter/receiver chain connected to an antenna to perform radiated tests.

In the client mode, 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 Safari web browser. In the Client-to-Client Communications mode, WLAN traffic is generated by streaming the video file TestFile.mp2 "6 ½ Magic Hours" from the Master, to the Slave, and mirror to the peer slave device in full motion video mode using Safari web browser.

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 of 20 MHz and 40 MHz are implemented in standard client mode. Two nominal channel bandwidths of 20 MHz and 40 MHz are implemented in Client-to-Client Communications Mode.

The software installed in the EUT is IOS 5.2.

UNIFORM CHANNEL SPREADING

This requirement is not applicable to Slave radio devices.

OVERVIEW OF MASTER DEVICE WITH RESPECT TO §15.407 (h) REQUIREMENTS

The Master Device is a Cisco Access Point, FCC ID: LDK102061. The minimum antenna gain for the Master Device is 3.5 dBi.

The rated output power of the Master unit is $> 23\text{dBm}$ (EIRP). Therefore the required interference threshold level is -64 dBm . After correction for procedural adjustments, the required radiated threshold at the antenna port is $-64 + 1 = -63\text{ dBm}$.

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.

The software installed in the access point is 12.4(25d)JA1.

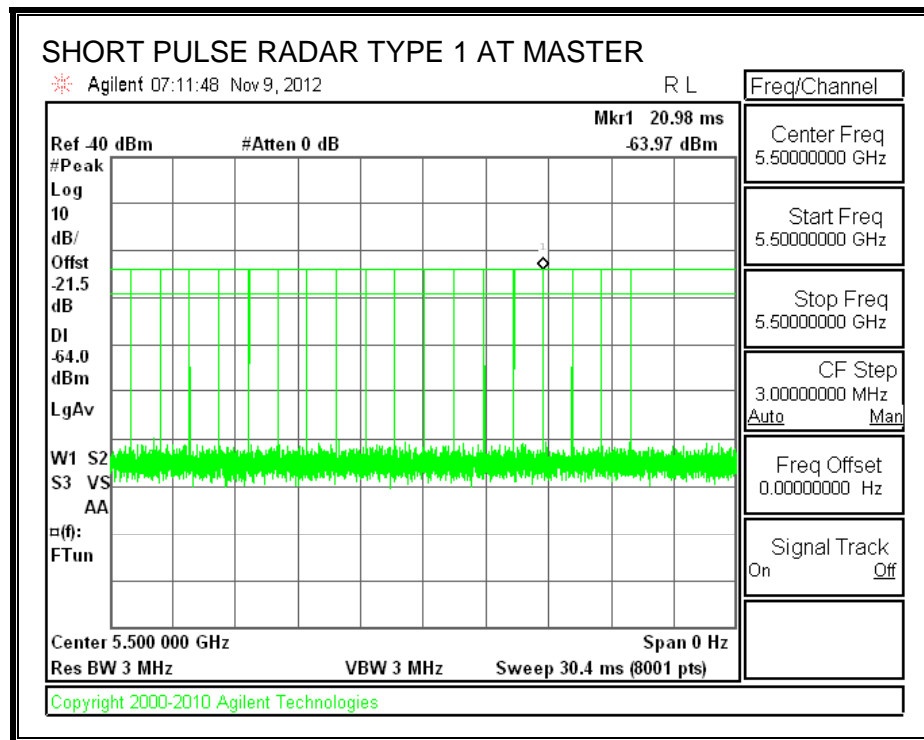
11.2. CLIENT MODE RESULTS FOR 20 MHz BANDWIDTH

11.2.1. TEST CHANNEL

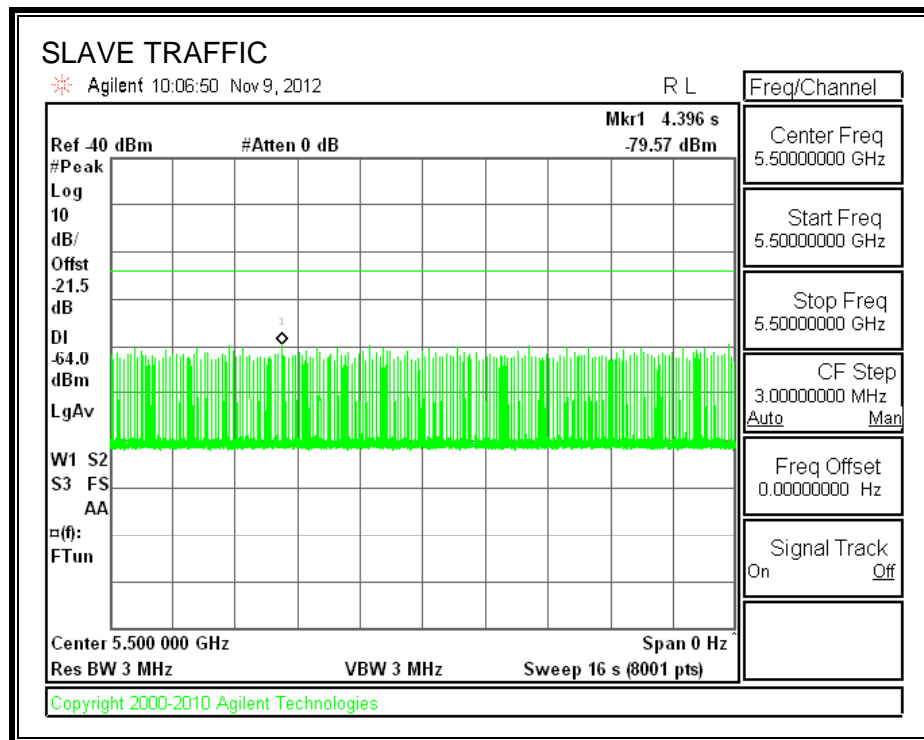
All tests were performed at a channel center frequency of 5500 MHz.

11.2.2. RADAR WAVEFORM AND TRAFFIC

RADAR WAVEFORM



TRAFFIC



11.2.3. OVERLAPPING CHANNEL TESTS

RESULTS

These tests are not applicable.

11.2.4. 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).

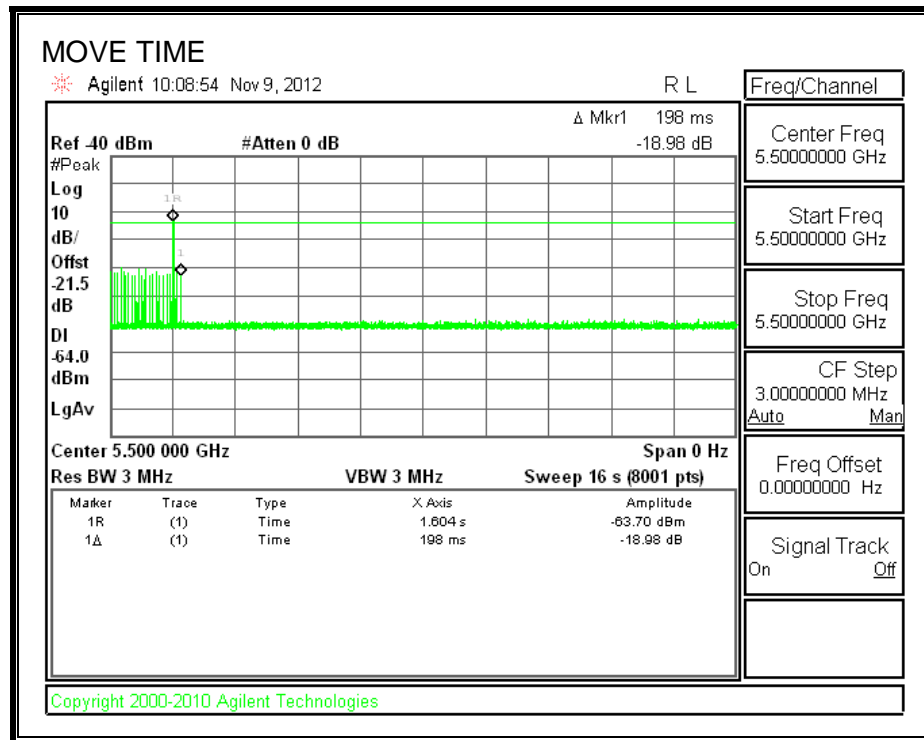
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

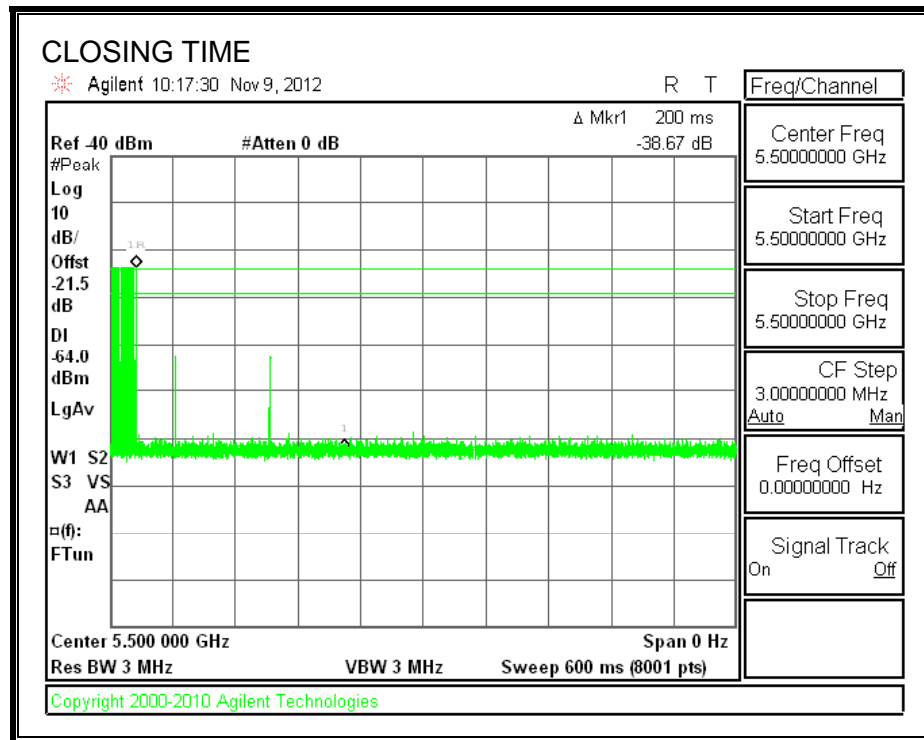
| Agency | Channel Move Time (sec) | Limit (sec) |
|----------|----------------------------|----------------|
| FCC / IC | 0.198 | 10 |

| Agency | Aggregate Channel Closing Transmission Time (msec) | Limit (msec) |
|--------|---|-----------------|
| FCC | 0.0 | 60 |
| IC | 8.0 | 260 |

MOVE TIME

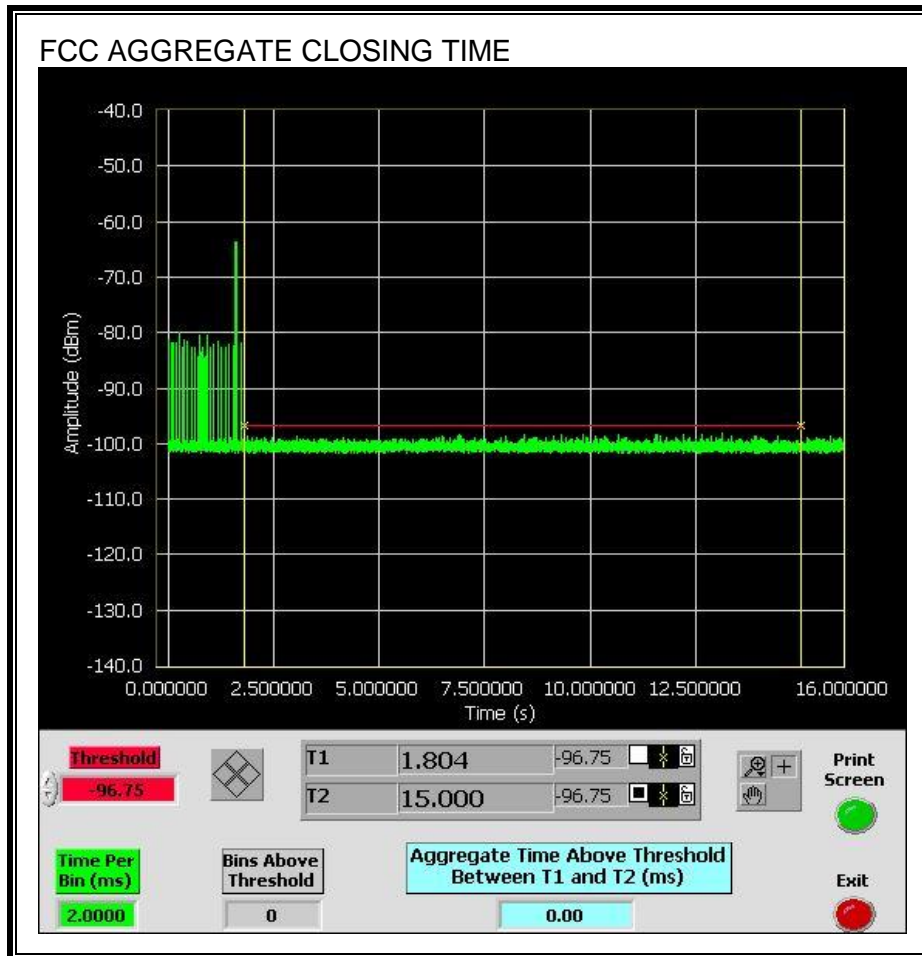


CHANNEL CLOSING TIME

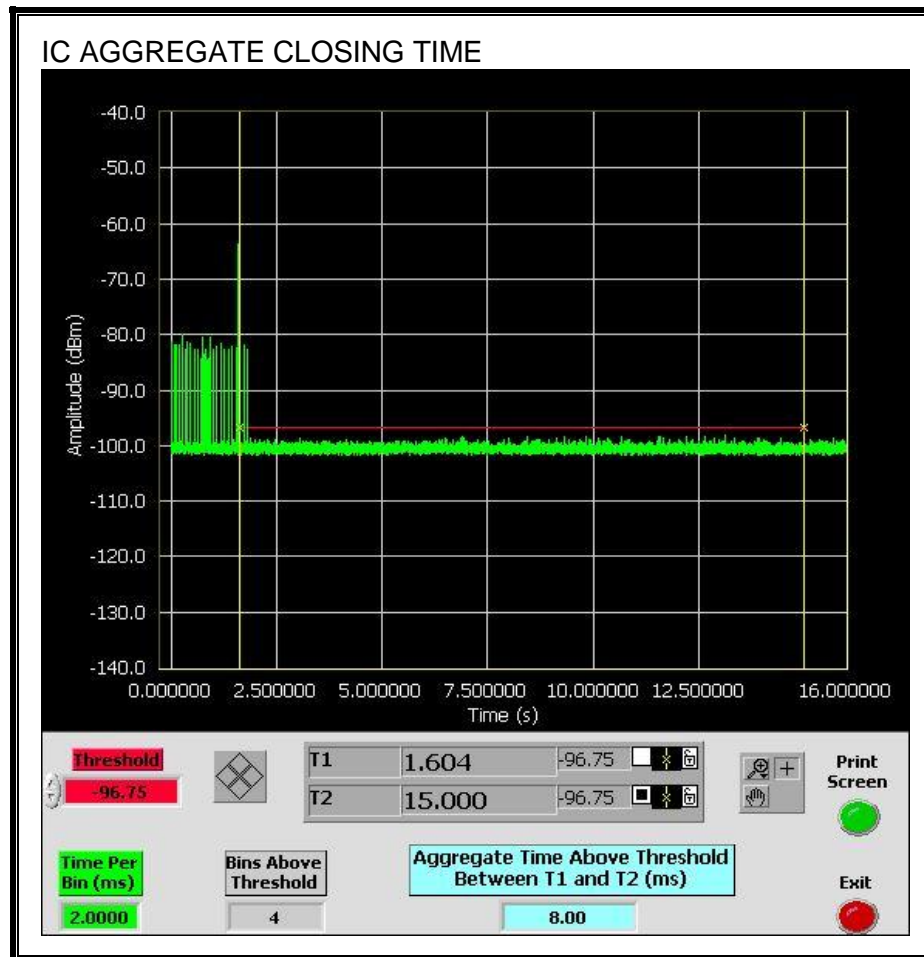


AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the FCC aggregate monitoring period.



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



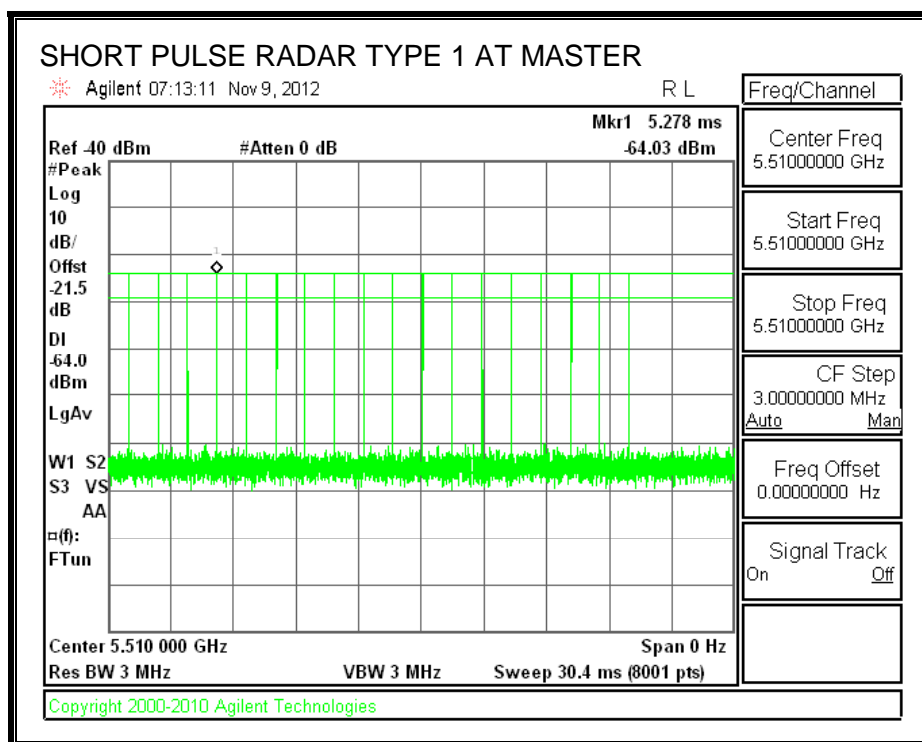
11.3. CLIENT MODE RESULTS FOR 40 MHz BANDWIDTH

11.3.1. TEST CHANNEL

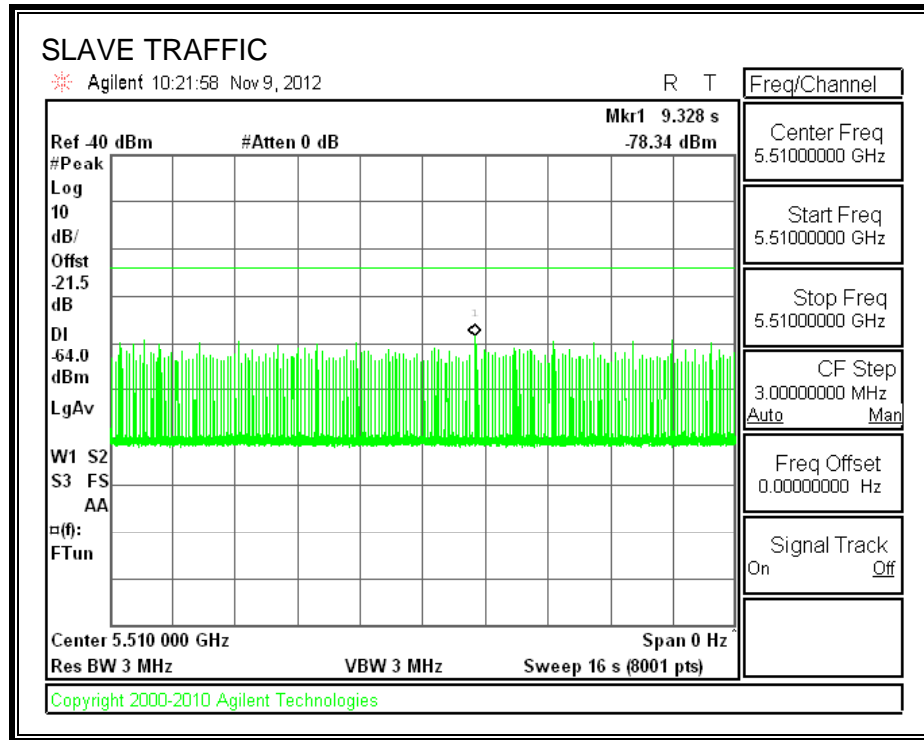
All tests were performed at a channel center frequency of 5510 MHz.

11.3.2. RADAR WAVEFORM AND TRAFFIC

RADAR WAVEFORM



TRAFFIC



11.3.3. OVERLAPPING CHANNEL TESTS

RESULTS

These tests are not applicable.

11.3.4. 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).

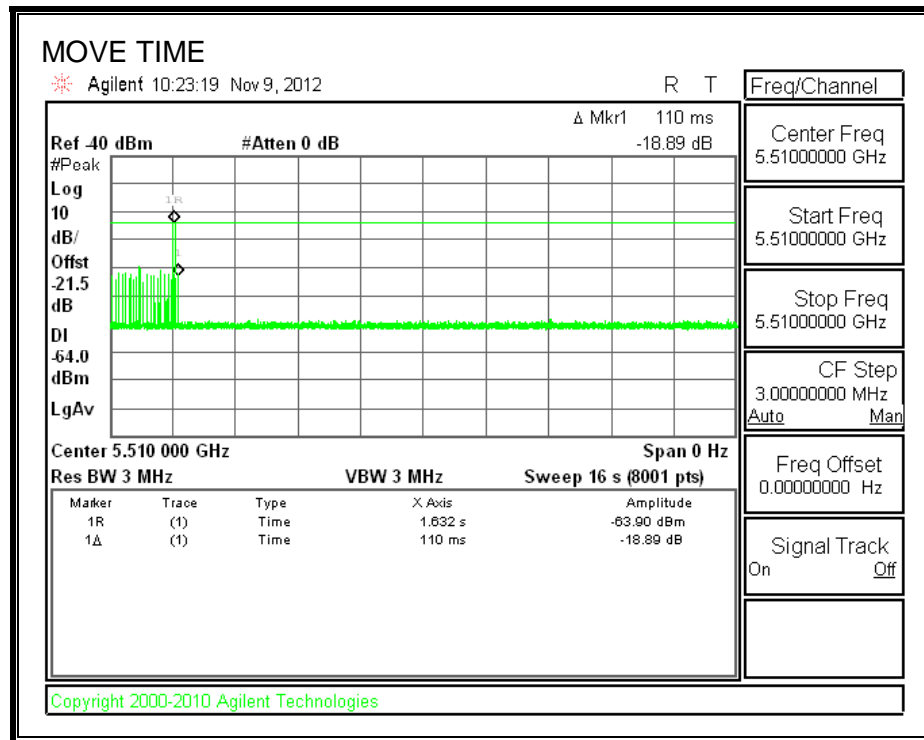
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

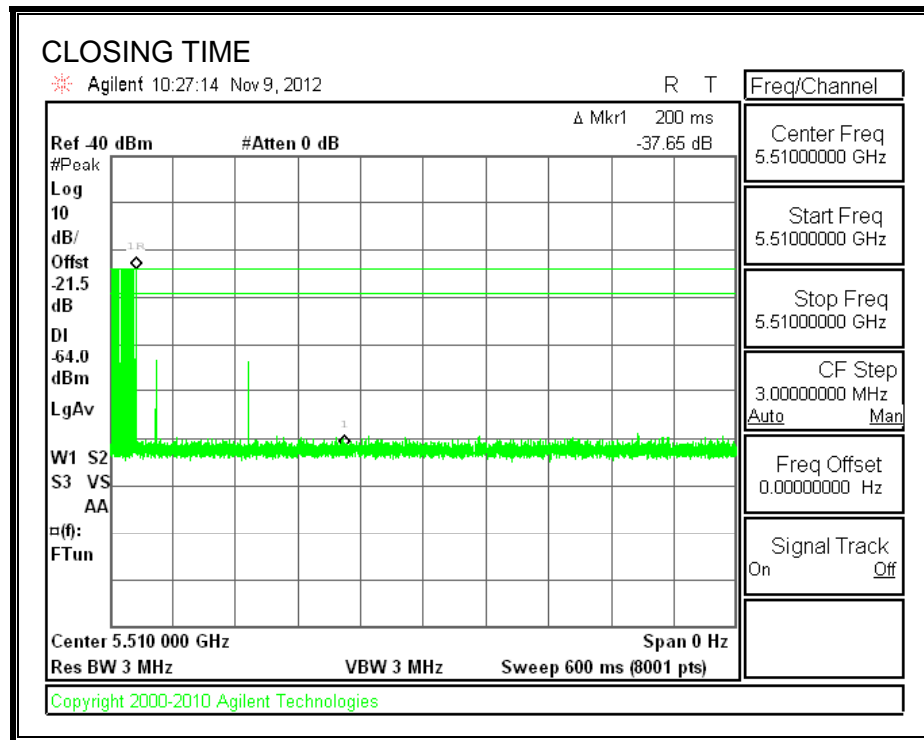
| Agency | Channel Move Time (sec) | Limit (sec) |
|----------|----------------------------|----------------|
| FCC / IC | 0.110 | 10 |

| Agency | Aggregate Channel Closing Transmission Time (msec) | Limit (msec) |
|--------|---|-----------------|
| FCC | 0.0 | 60 |
| IC | 8.0 | 260 |

MOVE TIME

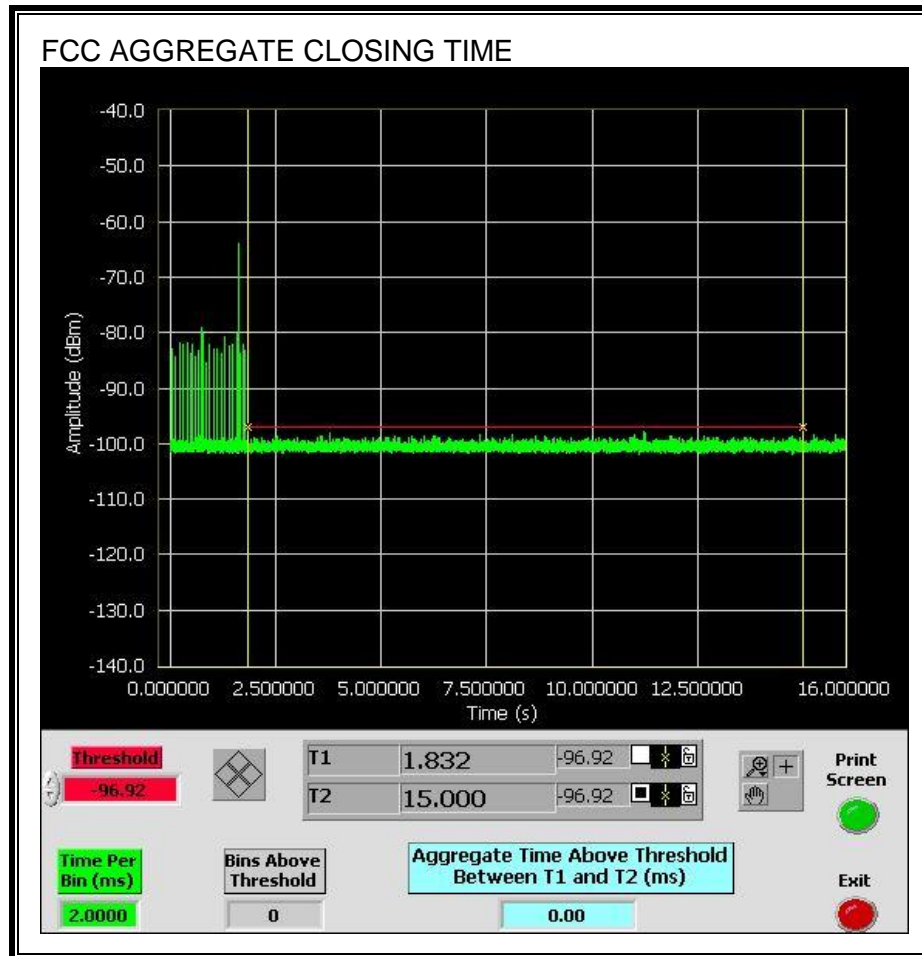


CHANNEL CLOSING TIME

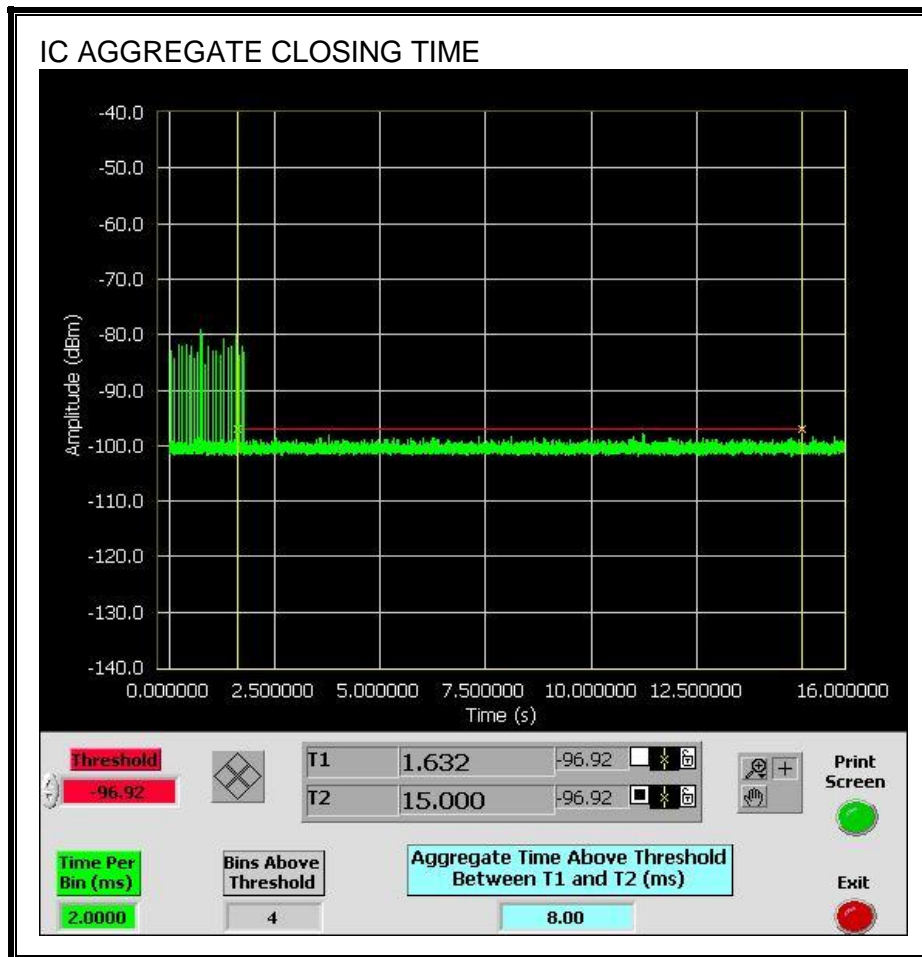


AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the FCC aggregate monitoring period.



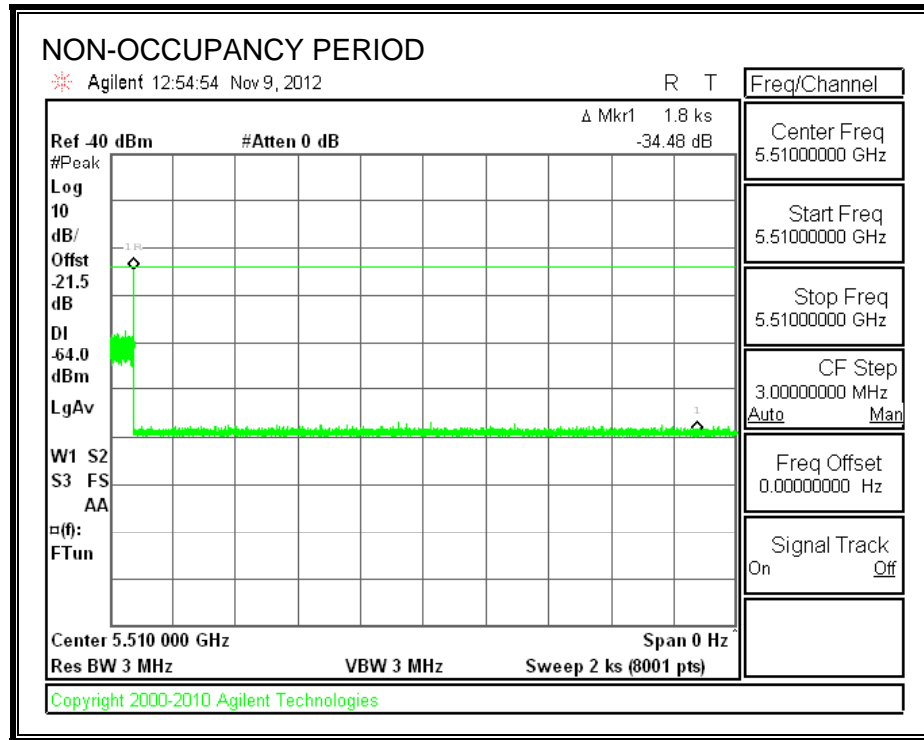
Only intermittent transmissions are observed during the IC aggregate monitoring period.



11.3.5. NON-OCCUPANCY PERIOD

RESULTS

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



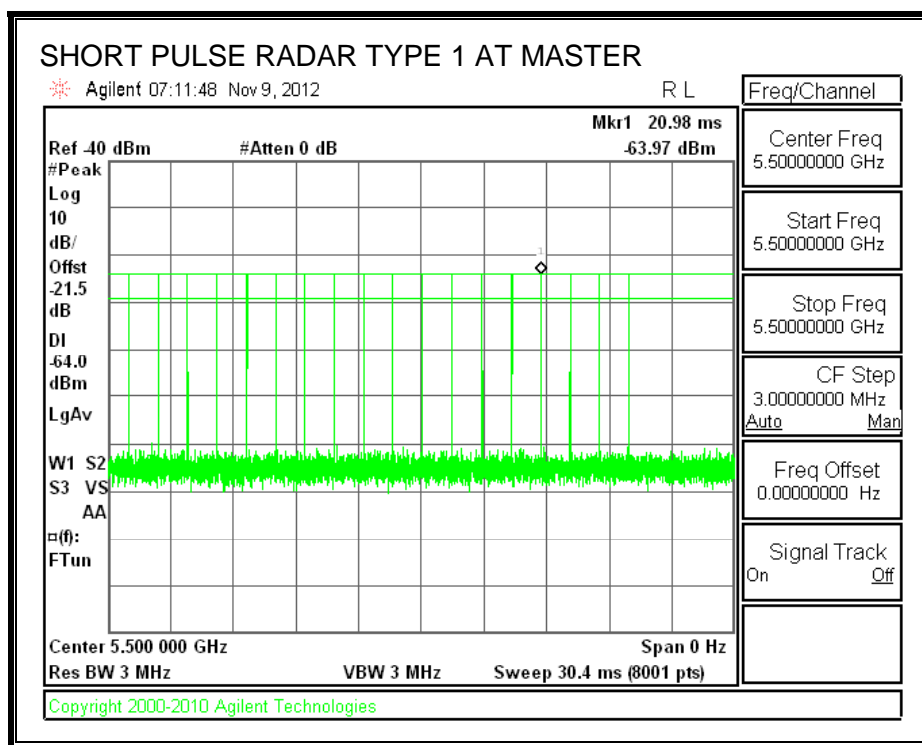
11.4. CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 20 MHz BANDWIDTH

11.4.1. TEST CHANNEL

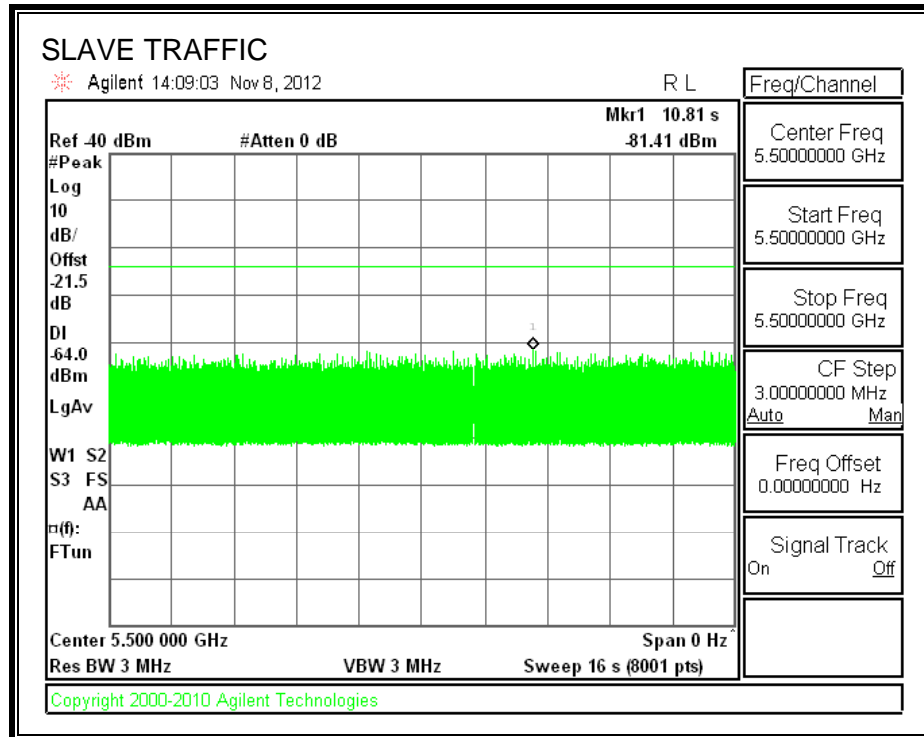
All tests were performed at a channel center frequency of 5500 MHz.

11.4.2. RADAR WAVEFORM AND TRAFFIC

RADAR WAVEFORM



TRAFFIC



11.4.3. OVERLAPPING CHANNEL TESTS

RESULTS

These tests are not applicable.

11.4.4. 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).

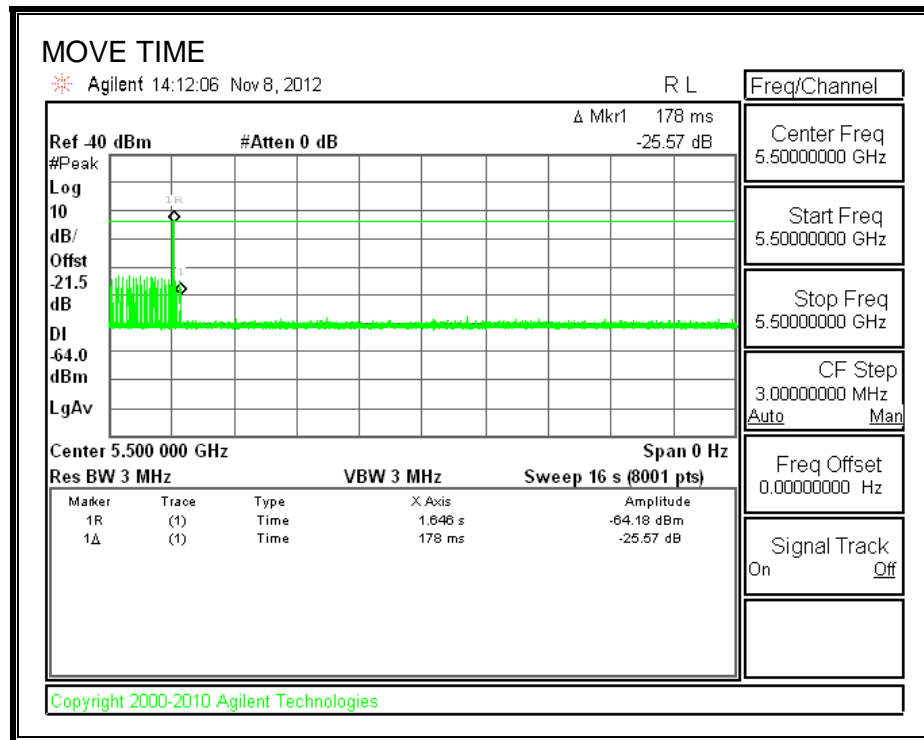
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

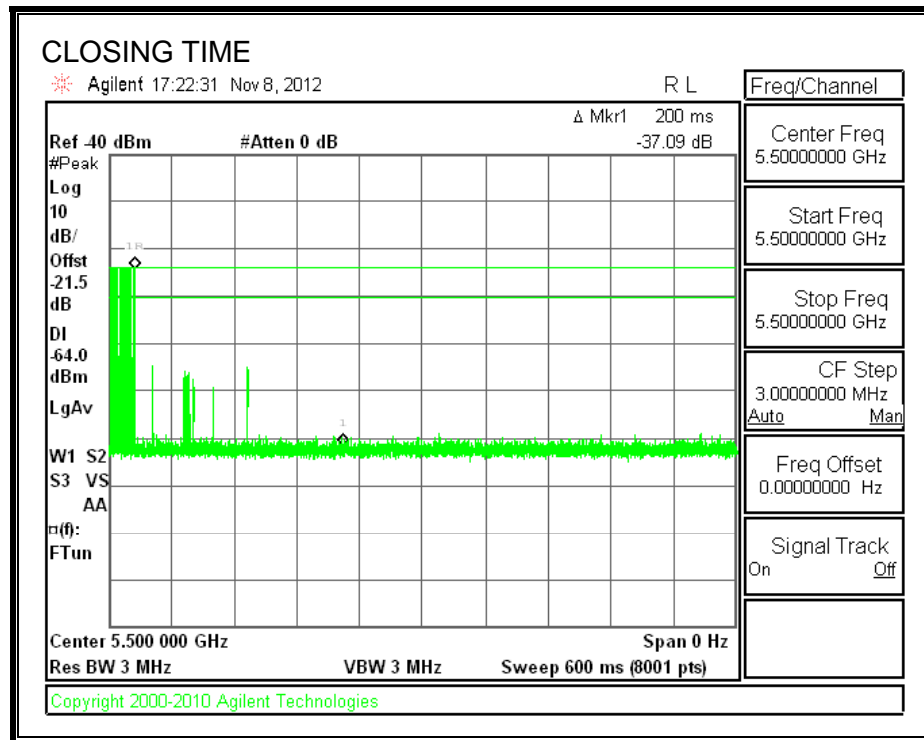
| Agency | Channel Move Time (sec) | Limit (sec) |
|----------|----------------------------|----------------|
| FCC / IC | 0.178 | 10 |

| Agency | Aggregate Channel Closing Transmission Time (msec) | Limit (msec) |
|--------|---|-----------------|
| FCC | 0.0 | 60 |
| IC | 24.0 | 260 |

MOVE TIME

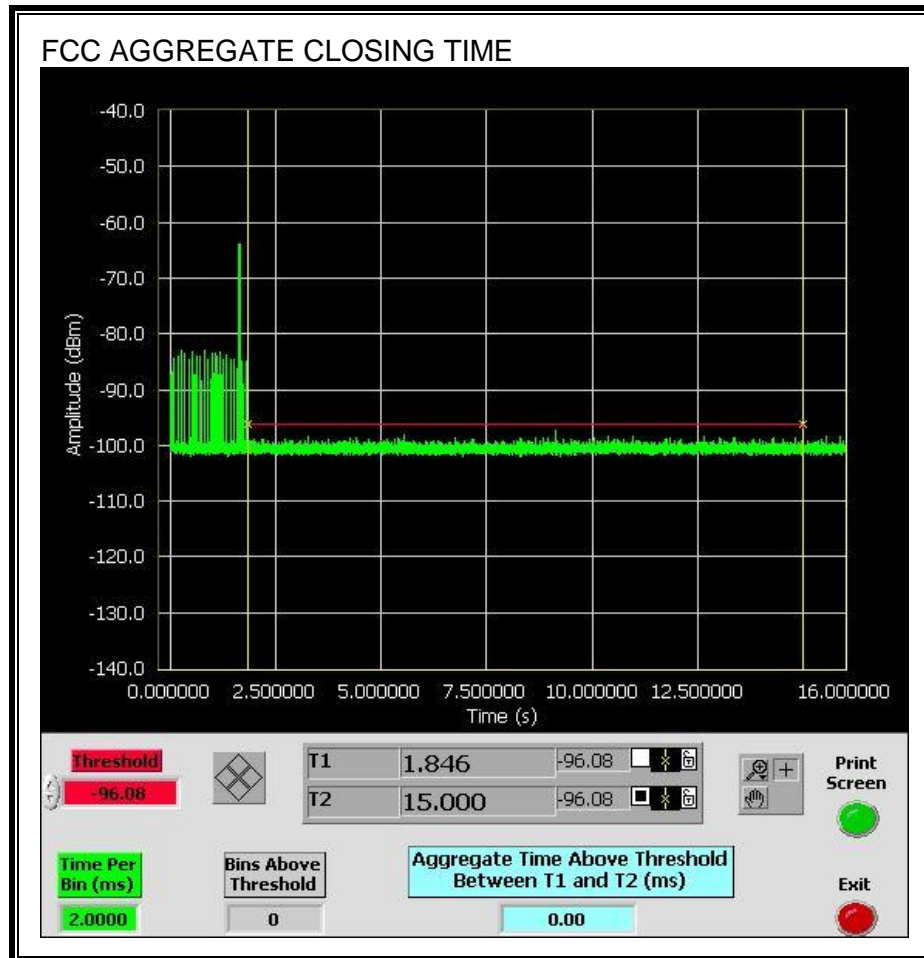


CHANNEL CLOSING TIME

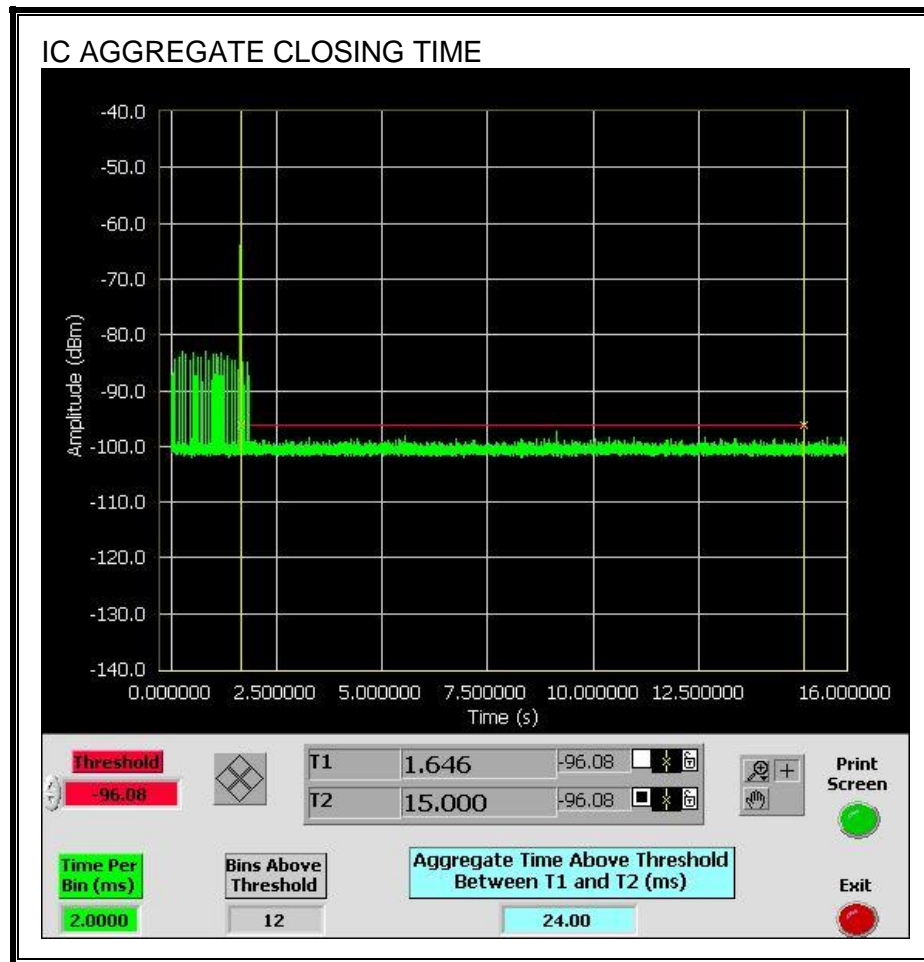


AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the FCC aggregate monitoring period.



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



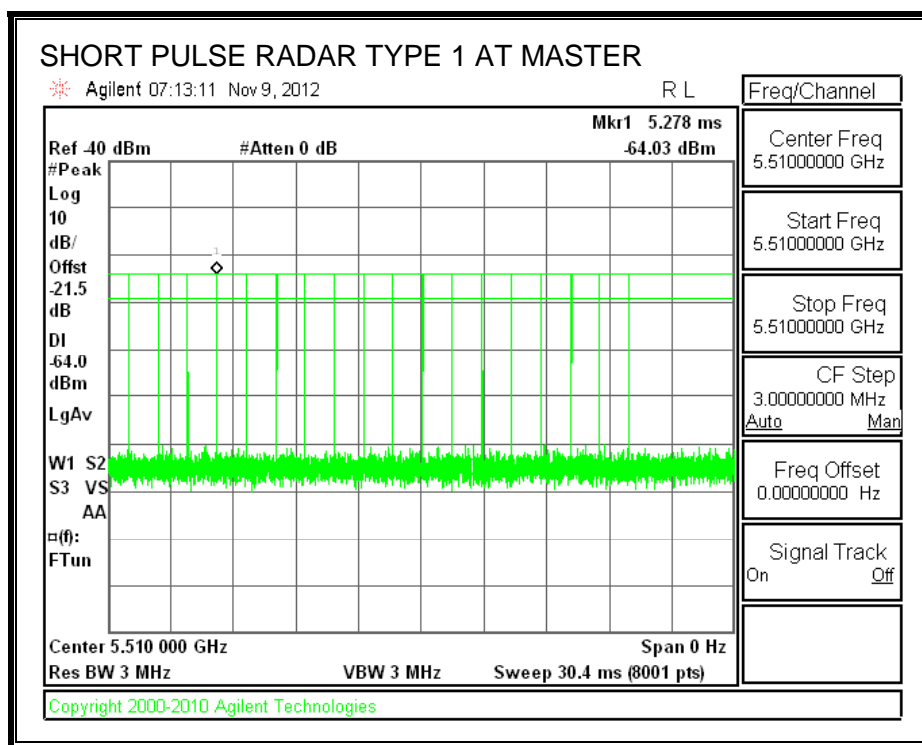
11.5. CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 40 MHz BANDWIDTH

11.5.1. TEST CHANNEL

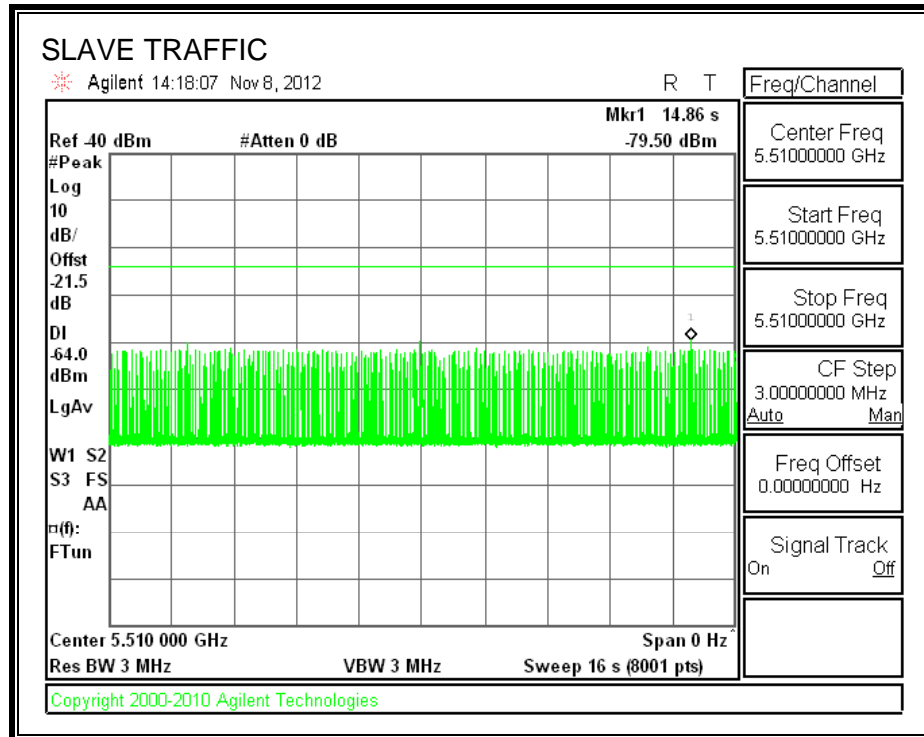
All tests were performed at a channel center frequency of 5510 MHz.

11.5.2. RADAR WAVEFORM AND TRAFFIC

RADAR WAVEFORM



TRAFFIC



11.5.3. OVERLAPPING CHANNEL TESTS

RESULTS

These tests are not applicable.

11.5.4. 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).

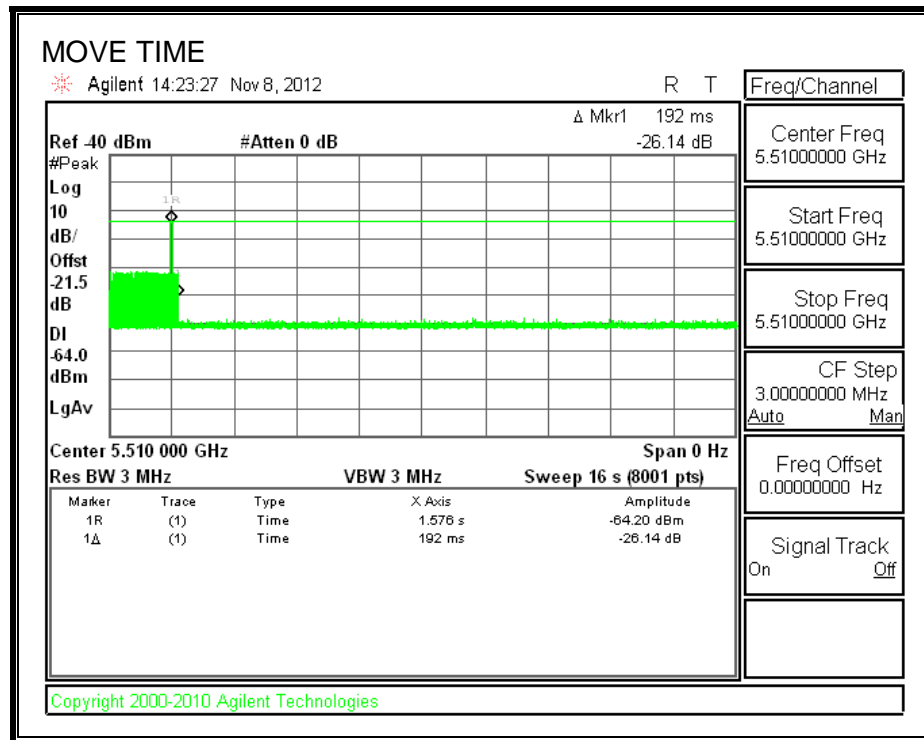
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

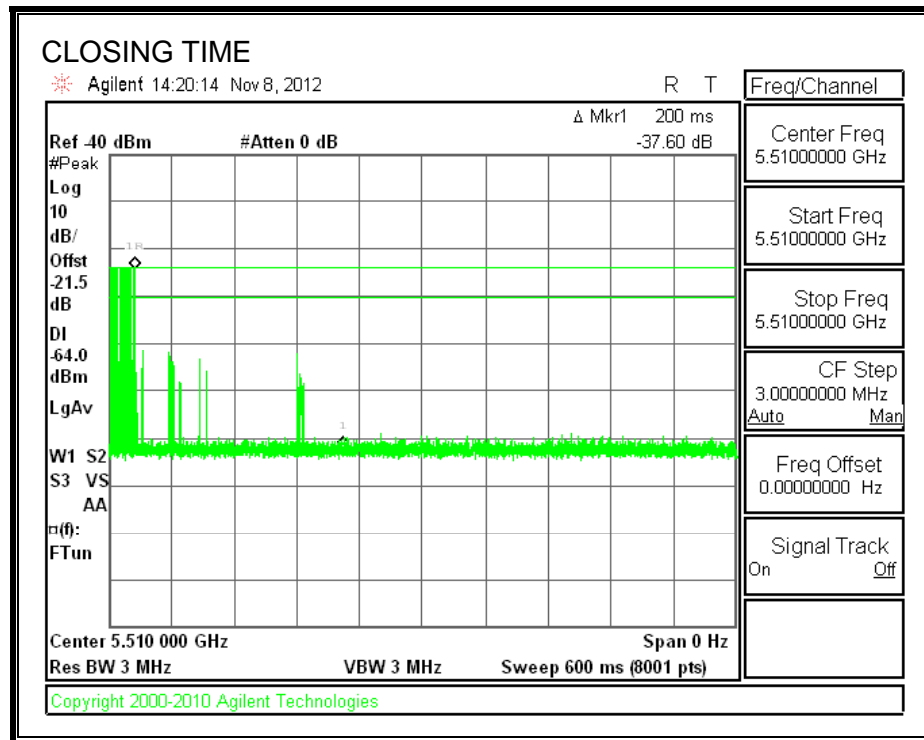
| Agency | Channel Move Time (sec) | Limit (sec) |
|----------|----------------------------|----------------|
| FCC / IC | 0.192 | 10 |

| Agency | Aggregate Channel Closing Transmission Time (msec) | Limit (msec) |
|--------|---|-----------------|
| FCC | 0.0 | 60 |
| IC | 28.0 | 260 |

MOVE TIME

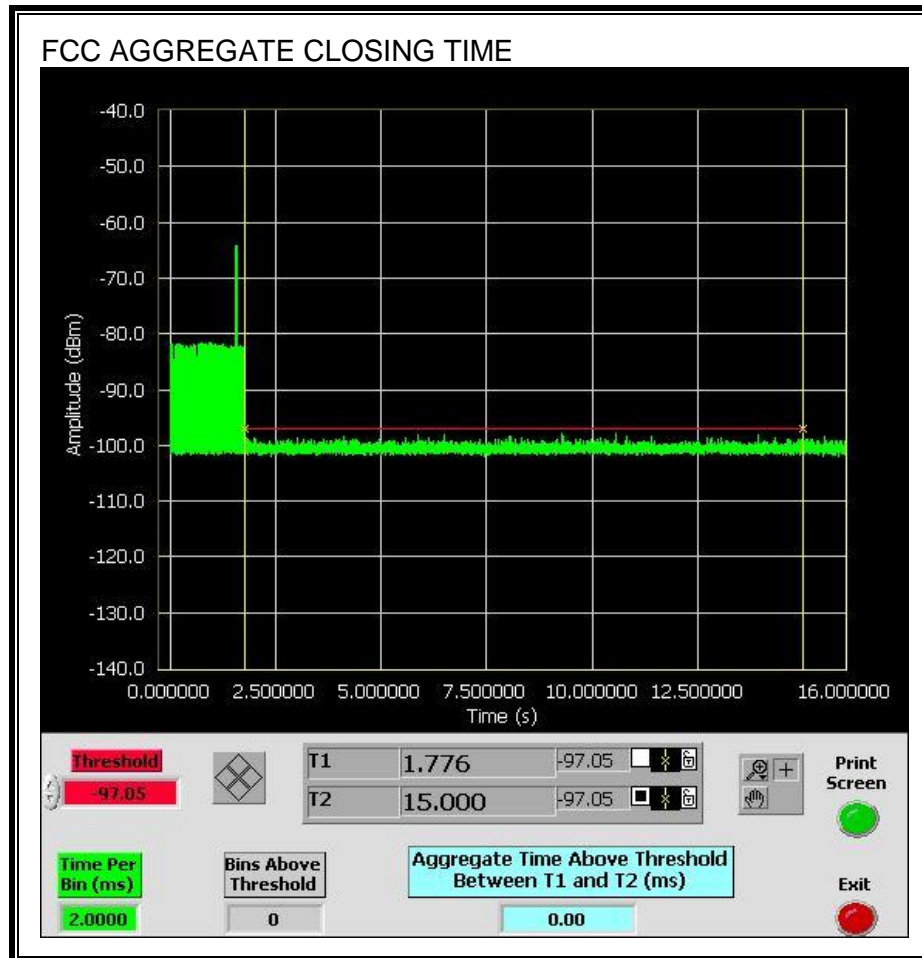


CHANNEL CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the FCC aggregate monitoring period.



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

