# Test Report

# AIR-CAP702W-A-K9

**FCC ID: LDK102092**
**IC:2461B-102092**

Also Covers:

AIR-CAP702W-D-K9

AIR-CAP702W-N-K9

AIR-CAP702W-Z-K9

## 5150-5250 MHz

**Against the following Specifications:**

**CFR47 Part 15.407**

**RSS210**

**Cisco Systems**
170 West Tasman Drive
San Jose, CA 95134

Test Engineer: _____

Date: 11/25/2013

This test report has been electronically authorized and archived using the CISCO Engineering Document Control system.

## Section 1: Overview

### 1.1 Test Summary

**samples were assessed against the tests detailed in section 3 under the requirements of the following specifications:**

| Emission | Immunity |
|---|---|
| CFR47 Part 15.407<br>RSS210 | N/A |

The specifications listed above represent actual tests performed to demonstrate compliance against the specifications and basic standards listed on the front cover of this report. This list is not a one to one match to the front cover for one or more of the following reasons.

1. Basic standards call up many different test phenomena specifications such as the 61000-4-X series. The basic standards define which elements and levels shall be applied from these specifications and as such it is not appropriate to list the individual specifications on the front cover.
2. A Standard listed on the front cover may be required in a particular country but is not appropriate for the particular technologies included in the equipment under test. E.g. You cannot test a DC product to the mains Harmonics requirements in EN61000-3-2. See section 3.2.
3. Test results against a particular standard or specification may be included in a different test report. See section 3.2 for an EDCS reference of this data.
4. Where appropriate, Cisco may have substituted a later revision of a basic standard to those referenced in the specification on the front sheet of this test report. This decision was based upon improved test methodology and repeatability and/or where the newer revision represented a more stringent test.
5. Where relevant, testing has been carried out to the requirements of both EN and IEC Specifications. This was possible because of the similarities of the test methods involved and the Cisco EMC test procedures.
6. Testing may have been performed to an equivalent test that satisfies the requirements of the standards and specifications listed on the front cover of the report. See section 3.2.
7. Where radiated emissions testing has been performed to EN55022/CISPR22 the additional requirements of VCCI: V- 3/2006.04, EN55022: 1994 +A1/2 and CAN/CSA- CISPR 22-02 have also been evaluated unless otherwise stated.
8. Testing to the requirements of CFR47 Part 15 was performed against the CISPR22 limits. The results are therefore deemed satisfactory evidence of compliance with Industry Canada Interference Causing Equipment Standard ICES-003.
9. Where assessment has been performed to CISPR24, all the applicable test requirements may have not been covered. Refer to the results section for the tests performed.

**Notes:**

1) Where a specification listed on the front cover of this report has deviations from the basic standards listed above, the additional technical requirements of the specification were also assessed.
2) Where appropriate, Cisco may have substituted a later revision of a basic standard to those referenced in the specification on the front sheet of this test report. This decision was based upon improved test methodology and repeatability and/or where the newer revision represented a more stringent test.
3) Where relevant, testing has been carried out to the requirements of both EN and IEC Specifications. This was possible because of the similarities of the test methods involved and the Cisco EMC test procedures.

## Section 2: Assessment Information

### 2.1 General

This report contains an assessment of an apparatus against Electromagnetic Compatibility Standards based upon tests carried out on the samples submitted. The testing was performed by and for the use of Cisco systems Inc:

With regard to this assessment, the following points should be noted:

a) The results contained in this report relate only to the items tested and were obtained in the period between the date of the initial assessment and the date of issue of the report. Manufactured products will not necessarily give identical results due to production and measurement tolerances.

b) The apparatus was set up and exercised using the configuration and modes of operation defined in this report only.

c) Where relevant, the apparatus was only assessed using the susceptibility criteria defined in this report and the Test Assessment Plan (TAP).

d) All testing was performed under the following environmental conditions:

| | |
|---|---|
| Temperature | 15°C to 35°C (54°F to 95°F) |
| Atmospheric Pressure | 860mbar to 1060mbar (25.4" to 31.3") |
| Humidity | 10% to 75*% |

*[Where applicable] For ESD testing the humidity limits used were 30% to 60% and for EFT/B tests the humidity limits used were 25% to 75%.

e) All AC testing was performed at one or more of the following supply voltages:
110V 60 Hz (+/-20%)
220V 50 Hz (+/-20%)

**2.2 Date of testing**

22-October-2013

**2.3 Report Issue Date**

Cisco uses an electronic system to issue, store and control the revision of test reports. This system is called the Engineering Document Control System (EDCS). The actual report issue date is embedded into the original file on EDCS. Any copies of this report, either electronic or paper, that are not on EDCS must be considered uncontrolled

**2.4 Testing facilities**

This assessment was performed by:

**Testing Laboratory**

| | |
|---|---|
| Cisco Systems, Inc., | Cisco Systems, Inc. |
| 4125 Highlander Parkway | 170 West Tasman Drive |
| Richfield, OH 44286 | San Jose, CA 95134 |
| USA | USA |

**Test Engineers**

Jim Nicholson

**2.5 Equipment Assessed (EUT)**

AIR-CAP702W-A-K9

### 2.6 EUT Description

The AIR-CAP702W-A-K9 Cisco Aironet 802.11n Radio Modules support the following modes of operation. The modes are further defined in the radio Theory of Operation. The modes included in this report represent the worst case data for all modes.

Non HT-20, One Antenna, 6 to 54 Mbps
Non HT-20, Two Antennas, 6 to 54 Mbps

Non HT-20 Beam Forming, Two Antennas, 6 to 54 Mbps

HT-20, One Antenna, M0 to M7
HT-20, Two Antennas, M0 to M15

HT-20 Beam Forming, Two Antennas, M0 to M15

HT-20 STBC, Two Antennas, M0 to M7

The following antennas are supported by this product series.
The data included in this report represent the worst case data for all antennas.

| Frequency | Part Number | Antenna Type | Antenna Gain (dBi) |
|---|---|---|---|
| **2.4/5 GHz** | Internal | Omni-Directional | 2 / 4 |

## Section 4: Sample Details

Note: Each sample was evaluated to ensure that its condition was suitable to be used as a test sample prior to the commencement of testing. Please also refer to the “Justification for worst Case test Configuration” section of this report for further details on the selection of EUT samples.

### 4.1 Sample Details (Photographs of the test samples, where appropriate can be found in appendix H)

| Sample No. | Equipment Details | Part Number | Manufacturer | Hardware Rev. | Firmware Rev. | Software Rev. | Serial Number |
|---|---|---|---|---|---|---|---|
| S01 | AIR-CAP702W-A-K9 | | Cisco Systems | NA | NA | NA | |
| S02 | AIR-PWRINJ5 | 341-0556-01 | Cisco Systems | NA | NA | NA | |
| | | | | | | | |

### 4.2 System Details

| System # | Description | Samples |
|---|---|---|
| 1 | EUT | S01, S02, S03 |

### 4.3 Mode of Operation Details

| Mode# | Description | Comments |
|---|---|---|
| 1 | Continuous Transmitting | Continuous Transmitting |

**Appendix A: Emission Test Results**

**Testing Laboratory:** Cisco Systems, Inc., 4125 Highlander Parkway, Richfield, OH, USA

## Target Maximum Channel Power

The following table details the maximum supported Total Channel Power for all operating modes.

| | Maximum Channel Power (dBm) | |
|---|---|---|
| | Frequency (MHz) | |
| Operating Mode | 5180 | 5240 |
| Non HT-20, 6 to 54 Mbps | 14 | 14 |
| Non HT-20 Beam Forming, 6 to 54 Mbps | 13 | 13 |
| HT-20, M0 to M15 | 14 | 14 |
| HT-20 Beam Forming, M0 to M15 | 14 | 14 |
| HT-20 STBC, M0 to M7 | 14 | 14 |
| | 5190 | 5230 |
| Non HT-40, 6 to 54 Mbps | 16 | 17 |
| HT-40, M0 to M15 | 16 | 17 |
| HT-40 Beam Forming, M0 to M15 | 16 | 17 |
| HT-40 STBC, M0 to M7 | 16 | 17 |

# 99% and 26dB Bandwidth

Connect the antenna port(s) to the spectrum analyzer input. Using the spectrum analyzer Channel Bandwidth mode, configure the spectrum analyzer as shown below (enter all losses between the transmitter output and the spectrum analyzer).

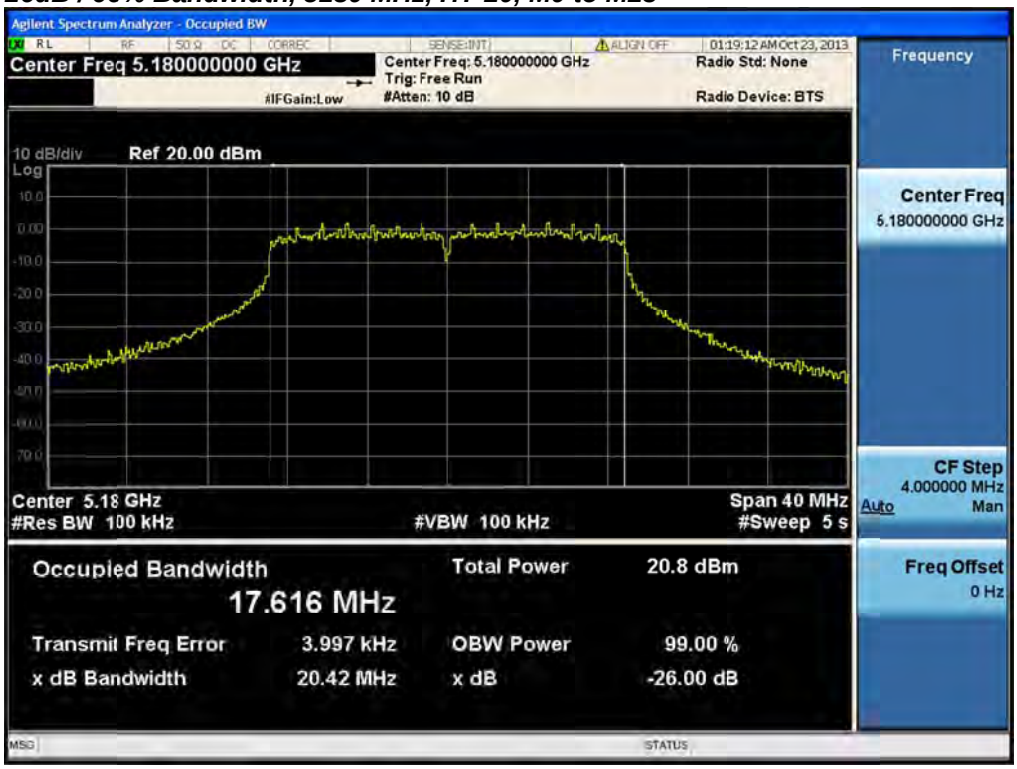
| | |
|---|---|
| Center Frequency: | Frequency from table below |
| Span: | 2 x Nominal Bandwidth (e.g. 40MHz for a 20MHz channel) |
| Reference Level: | 20 dBm |
| Attenuation: | 10 dB |
| Sweep Time: | 5 s |
| Resolution Bandwidth: | 1%-3% of 26 dB Bandwidth |
| Video Bandwidth: | ≥Resolution Bandwidth |
| X dB Bandwidth: | 26 dB |
| Detector: | Peak |
| Trace: | Single |

Place the radio in continuous transmit mode. View the transmitter waveform on the spectrum analyzer, and record the pertinent measurements:

| Frequency (MHz) | Mode | Data Rate (Mbps) | 26dB BW (MHz) | 99% BW (MHz) |
|---|---|---|---|---|
| 5180 | Non HT-20, 6 to 54 Mbps | 6 | 19.4 | 16.4 |
| | HT-20, M0 to M23 | m0 | 20.4 | 17.6 |
| | | | | |
| 5190 | Non HT-40, 6 to 54 Mbps | 6 | 39.7 | 36.1 |
| | HT-40, M0 to M23 | m0 | 39.7 | 36.1 |
| | | | | |
| 5230 | Non HT-40, 6 to 54 Mbps | 6 | 39.7 | 36.1 |
| | HT-40, M0 to M23 | m0 | 39.8 | 36.1 |
| | | | | |
| 5240 | Non HT-20, 6 to 54 Mbps | 6 | 19.4 | 16.4 |
| | HT-20, M0 to M23 | m0 | 20.3 | 17.6 |

***26dB / 99% Bandwidth, 5180 MHz, Non HT-20, 6 to 54 Mbps***


***26dB / 99% Bandwidth, 5180 MHz, HT-20, M0 to M23***



***26dB / 99% Bandwidth, 5190 MHz, Non HT-40, 6 to 54 Mbps***

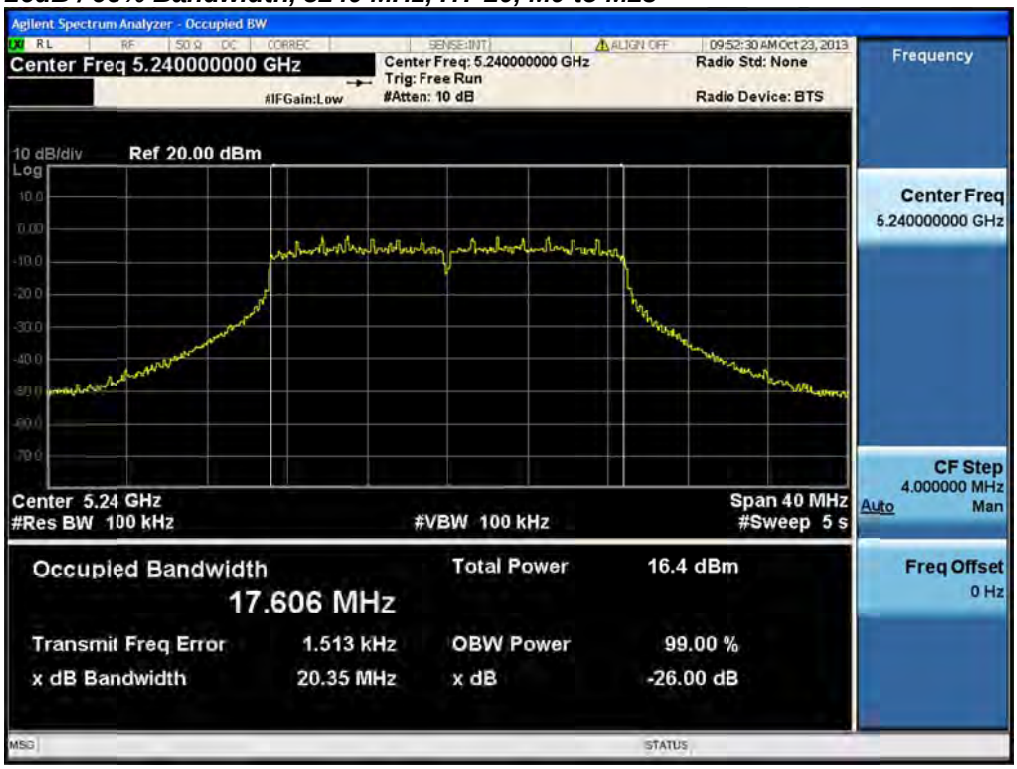

***26dB / 99% Bandwidth, 5190 MHz, HT-40, M0 to M23***

***26dB / 99% Bandwidth, 5230 MHz, Non HT-40, 6 to 54 Mbps***


***26dB / 99% Bandwidth, 5230 MHz, HT-40, M0 to M23***

***26dB / 99% Bandwidth, 5240 MHz, Non HT-20, 6 to 54 Mbps***


***26dB / 99% Bandwidth, 5240 MHz, HT-20, M0 to M23***



## Peak Output Power

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

The smallest 26dB bandwidth for all channels is 19.4 MHz. The maximum conducted output power is calculated as 4dBm+10*log(20.7MHz) = 16.9dBm

The maximum supported antenna gain is 4dBi. The peak correlated gain for each mode is listed in the table below. See the Theory of Operation for details on the correlated gain for each mode.

The “measure-and-sum technique” is used for measuring in-band transmit power of a device. In the measure-and-sum approach, the conducted emission level is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in linear power units.

## Power Spectral Density

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

The maximum supported antenna gain is 4dBi. The peak correlated gain for each mode is listed in the table below. See the Theory of Operation for details on the correlated gain for each mode.

The “Measure and add 10 log(N) dB technique”, where N is the number of outputs, is used for measuring in-band Power Spectral Density. With this technique, spectrum measurements are performed at each output of the device, and the quantity 10 log(4) (or 6dB) is added to the worst case spectrum value before comparing to the emission limit.

Connect the antenna port(s) to the spectrum analyzer input. Place the radio in continuous transmit mode. Configure the spectrum analyzer as shown below.

| | |
|---|---|
| Enable "Channel Power" function of analyzer | |
| Center Frequency: | Frequency from table below |
| Span: | 20 MHz (must be greater than 26dB bandwidth, adjust as necessary) |
| Ref Level Offset: | Correct for attenuator and cable loss. |
| Reference Level: | 20 dBm |
| Attenuation: | 20 dB |
| Sweep Time: | 100ms, Single sweep |
| Resolution Bandwidth: | 1 MHz |
| Video Bandwidth: | 3 MHz |
| Detector: | Sample |
| Trace: | Trace Average 100 traces in Power Averaging Mode |
| Integration BW: | =99 % BW from 99% Bandwidth Data |

After averaging 100 traces of the transmitter waveform on the spectrum analyzer, record the spectrum analyzer Channel Power. Perform a Marker Peak Search function, and record this value as the Power Spectral Density.

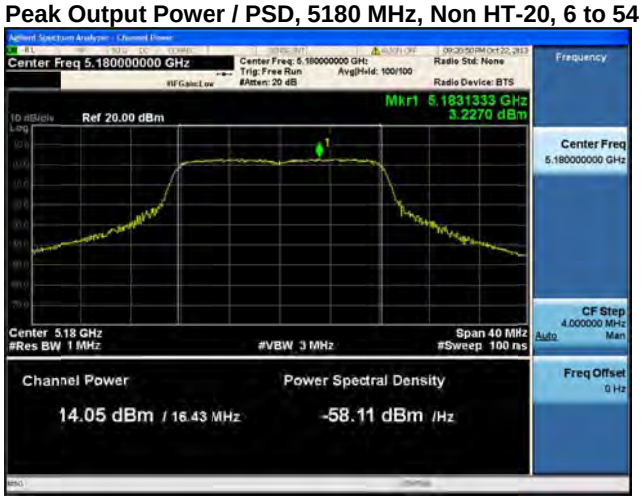
| Frequency (MHz) | Mode | Tx Paths | Correlated Antenna Gain (dBi) | Tx 1 Max Power (dBm) | Tx 2 Max Power (dBm) | Total Tx Channel Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 5180 | Non HT-20, 6 to 54 Mbps | 1 | 4 | 14.1 | | 14.1 | 17 | 2.9 |
| | Non HT-20, 6 to 54 Mbps | 2 | 4 | 9.8 | 10.4 | 13.1 | 17 | 3.9 |
| | Non HT-20 Beam Forming, 6 to 54 Mbps | 2 | 7 | 9.8 | 10.4 | 13.1 | 16 | 2.9 |
| | HT-20, M0 to M7 | 1 | 4 | 14.1 | | 14.1 | 17 | 2.9 |
| | HT-20, M0 to M7 | 2 | 4 | 9.7 | 10.0 | 12.9 | 17 | 4.1 |
| | HT-20, M8 to M15 | 2 | 4 | 11.1 | 11.2 | 14.2 | 17 | 2.8 |
| | HT-20 Beam Forming, M0 to M7 | 2 | 7 | 9.7 | 10.0 | 12.9 | 16 | 3.1 |
| | HT-20 Beam Forming, M8 to M15 | 2 | 4 | 11.1 | 11.2 | 14.2 | 17 | 2.8 |
| | HT-20 STBC, M0 to M7 | 2 | 4 | 11.1 | 11.2 | 14.2 | 17 | 2.8 |
| | | | | | | | | |
| 5190 | Non HT-40, 6 to 54 Mbps | 1 | 4 | 15.1 | | 15.1 | 17 | 1.9 |
| | Non HT-40, 6 to 54 Mbps | 2 | 4 | 13.1 | 13.4 | 16.3 | 17 | 0.7 |
| | HT-40, M0 to M7 | 1 | 4 | 14.3 | | 14.3 | 17 | 2.7 |
| | HT-40, M0 to M7 | 2 | 4 | 12.4 | 12.7 | 15.6 | 17 | 1.4 |
| | HT-40, M8 to M15 | 2 | 4 | 12.4 | 12.7 | 15.6 | 17 | 1.4 |
| | HT-40 Beam Forming, M0 to M7 | 2 | 7 | 9.0 | 9.8 | 12.4 | 16 | 3.6 |
| | HT-40 Beam Forming, M8 to M15 | 2 | 4 | 12.4 | 12.7 | 15.6 | 17 | 1.4 |
| | HT-40 STBC, M0 to M7 | 2 | 4 | 12.4 | 12.7 | 15.6 | 17 | 1.4 |
| | | | | | | | | |
| 5230 | Non HT-40, 6 to 54 Mbps | 1 | 4 | 17.0 | | 17.0 | 17 | 0.0 |
| | Non HT-40, 6 to 54 Mbps | 2 | 4 | 13.2 | 13.2 | 16.2 | 17 | 0.8 |
| | HT-40, M0 to M7 | 1 | 4 | 16.6 | | 16.6 | 17 | 0.4 |
| | HT-40, M0 to M7 | 2 | 4 | 13.7 | 13.7 | 16.7 | 17 | 0.3 |
| | HT-40, M8 to M15 | 2 | 4 | 13.7 | 13.7 | 16.7 | 17 | 0.3 |
| | HT-40 Beam Forming, M0 to M7 | 2 | 7 | 12.7 | 12.7 | 15.7 | 16 | 0.3 |
| | HT-40 Beam Forming, M8 to M15 | 2 | 4 | 13.7 | 13.7 | 16.7 | 17 | 0.3 |
| | HT-40 STBC, M0 to M7 | 2 | 4 | 13.7 | 13.7 | 16.7 | 17 | 0.3 |
| | | | | | | | | |
| 5240 | Non HT-20, 6 to 54 Mbps | 1 | 4 | 14.3 | | 14.3 | 17 | 2.7 |
| | Non HT-20, 6 to 54 Mbps | 2 | 4 | 9.8 | 10.2 | 13.0 | 17 | 4.0 |
| | Non HT-20 Beam Forming, 6 to 54 Mbps | 2 | 7 | 9.8 | 10.2 | 13.0 | 16 | 3.0 |
| | HT-20, M0 to M7 | 1 | 4 | 14.0 | | 14.0 | 17 | 3.0 |
| | HT-20, M0 to M7 | 2 | 4 | 9.4 | 10.0 | 12.7 | 17 | 4.3 |
| | HT-20, M8 to M15 | 2 | 4 | 10.4 | 11.0 | 13.7 | 17 | 3.3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | HT-20 Beam Forming, M0 to M7 | 2 | 7 | 9.4 | 10.0 | 12.7 | 16 | 3.3 |
| | HT-20 Beam Forming, M8 to M15 | 2 | 4 | 10.4 | 11.0 | 13.7 | 17 | 3.3 |
| | HT-20 STBC, M0 to M7 | 2 | 4 | 10.4 | 11.0 | 13.7 | 17 | 3.3 |

| Frequency (MHz) | Mode | Tx Paths | Correlated Antenna Gain (dBi) | Tx 1 PSD (dBm/MHz) | Tx 2 PSD (dBm/MHz) | Total PSD (dBm/MHz) | Limit (dBm/MHz) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 5180 | Non HT-20, 6 to 54 Mbps | 1 | 4 | 3.2 | | 3.2 | 4.0 | 0.8 |
| | Non HT-20, 6 to 54 Mbps | 2 | 7 | -0.7 | -0.5 | 2.4 | 3.0 | 0.6 |
| | Non HT-20 Beam Forming, 6 to 54 Mbps | 2 | 7 | -0.7 | -0.5 | 2.4 | 3.0 | 0.6 |
| | HT-20, M0 to M7 | 1 | 4 | 3.1 | | 3.1 | 4.0 | 0.9 |
| | HT-20, M0 to M7 | 2 | 7 | -1.3 | -0.8 | 2.0 | 3.0 | 1.0 |
| | HT-20, M8 to M15 | 2 | 4 | 0.5 | 0.4 | 3.5 | 4.0 | 0.5 |
| | HT-20 Beam Forming, M0 to M7 | 2 | 7 | -1.3 | -0.8 | 2.0 | 3.0 | 1.0 |
| | HT-20 Beam Forming, M8 to M15 | 2 | 4 | 0.5 | 0.4 | 3.5 | 4.0 | 0.5 |
| | HT-20 STBC, M0 to M7 | 2 | 4 | 0.5 | 0.4 | 3.5 | 4.0 | 0.5 |
| | | | | | | | | |
| 5190 | Non HT-40, 6 to 54 Mbps | 1 | 4 | 3.6 | | 3.6 | 4.0 | 0.4 |
| | Non HT-40, 6 to 54 Mbps | 2 | 7 | -0.4 | -0.1 | 2.8 | 3.0 | 0.2 |
| | HT-40, M0 to M7 | 1 | 4 | 2.3 | | 2.3 | 4.0 | 1.7 |
| | HT-40, M0 to M7 | 2 | 7 | -0.4 | -0.2 | 2.7 | 3.0 | 0.3 |
| | HT-40, M8 to M15 | 2 | 4 | -0.4 | -0.2 | 2.7 | 4.0 | 1.3 |
| | HT-40 Beam Forming, M0 to M7 | 2 | 7 | -1.6 | -0.8 | 1.8 | 3.0 | 1.2 |
| | HT-40 Beam Forming, M8 to M15 | 2 | 4 | -0.4 | -0.2 | 2.7 | 4.0 | 1.3 |
| | HT-40 STBC, M0 to M7 | 2 | 4 | -0.4 | -0.2 | 2.7 | 4.0 | 1.3 |
| | | | | | | | | |
| 5230 | Non HT-40, 6 to 54 Mbps | 1 | 4 | 3.4 | | 3.4 | 4.0 | 0.6 |
| | Non HT-40, 6 to 54 Mbps | 2 | 7 | -0.5 | 0.0 | 2.8 | 3.0 | 0.2 |
| | HT-40, M0 to M7 | 1 | 4 | 2.5 | | 2.5 | 4.0 | 1.5 |
| | HT-40, M0 to M7 | 2 | 7 | -0.3 | 0.0 | 2.9 | 3.0 | 0.1 |
| | HT-40, M8 to M15 | 2 | 4 | -0.3 | 0.0 | 2.9 | 4.0 | 1.1 |
| | HT-40 Beam Forming, M0 to M7 | 2 | 7 | -1.0 | -1.3 | 1.9 | 3.0 | 1.1 |
| | HT-40 Beam Forming, M8 to M15 | 2 | 4 | -0.3 | 0.0 | 2.9 | 4.0 | 1.1 |
| | HT-40 STBC, M0 to M7 | 2 | 4 | -0.3 | 0.0 | 2.9 | 4.0 | 1.1 |
| | | | | | | | | |
| 5240 | Non HT-20, 6 to 54 Mbps | 1 | 4 | 3.7 | | 3.7 | 4.0 | 0.3 |
| | Non HT-20, 6 to 54 Mbps | 2 | 7 | -1.0 | -0.5 | 2.3 | 3.0 | 0.7 |
| | Non HT-20 Beam Forming, 6 to 54 Mbps | 2 | 7 | -1.0 | -0.5 | 2.3 | 3.0 | 0.7 |
| | HT-20, M0 to M7 | 1 | 4 | 3.4 | | 3.4 | 4.0 | 0.6 |
| | HT-20, M0 to M7 | 2 | 7 | -1.5 | -0.7 | 1.9 | 3.0 | 1.1 |
| | HT-20, M8 to M15 | 2 | 4 | 0.2 | 0.6 | 3.4 | 4.0 | 0.6 |

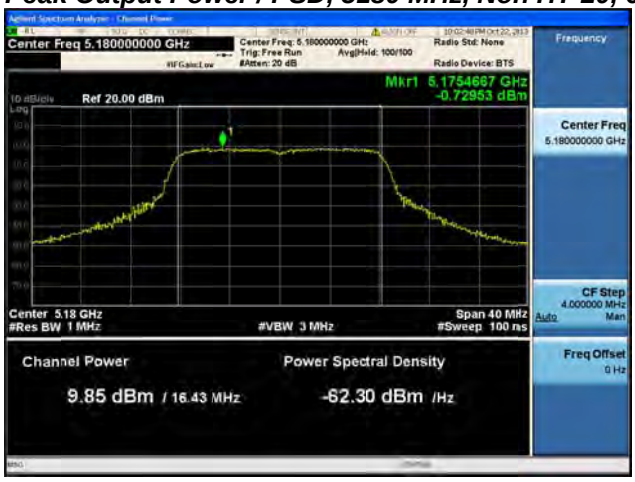
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | HT-20 Beam Forming, M0 to M7 | 2 | 7 | -1.5 | -0.7 | 1.9 | 3.0 | 1.1 |
| | HT-20 Beam Forming, M8 to M15 | 2 | 4 | 0.2 | 0.6 | 3.4 | 4.0 | 0.6 |
| | HT-20 STBC, M0 to M7 | 2 | 4 | 0.2 | 0.6 | 3.4 | 4.0 | 0.6 |

**Peak Output Power / PSD, 5180 MHz, Non HT-20, 6 to 54 Mbps**

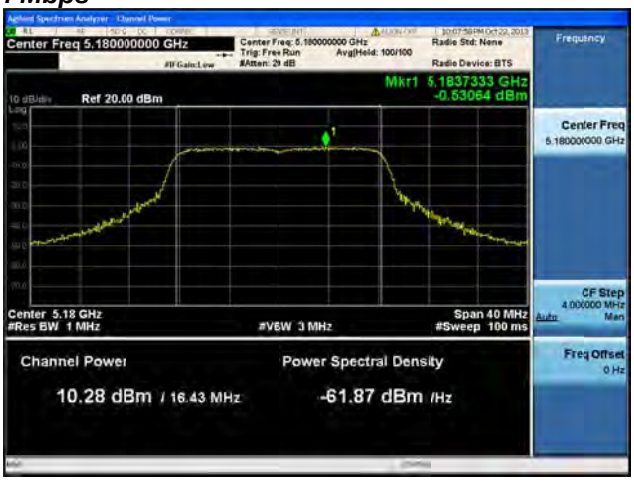



***Antenna A***

***Peak Output Power / PSD, 5180 MHz, Non HT-20, 6 to 54 Mbps***

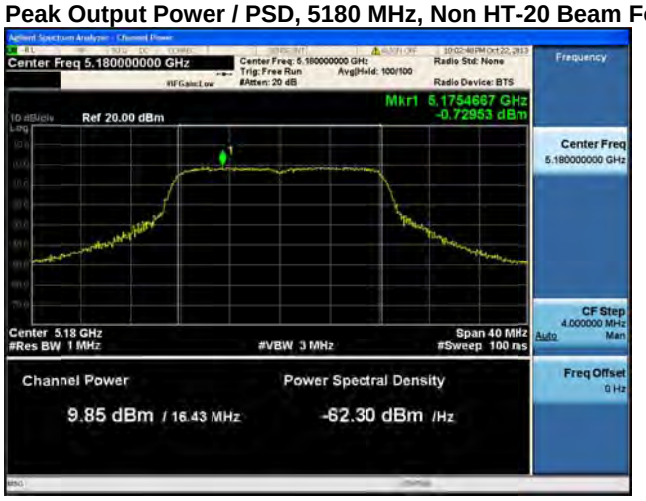



***Antenna A***

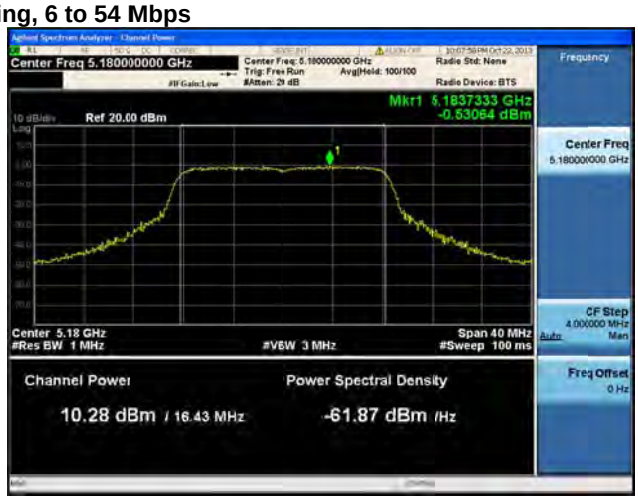



***Antenna B***

**Peak Output Power / PSD, 5180 MHz, Non HT-20 Beam Forming, 6 to 54 Mbps**

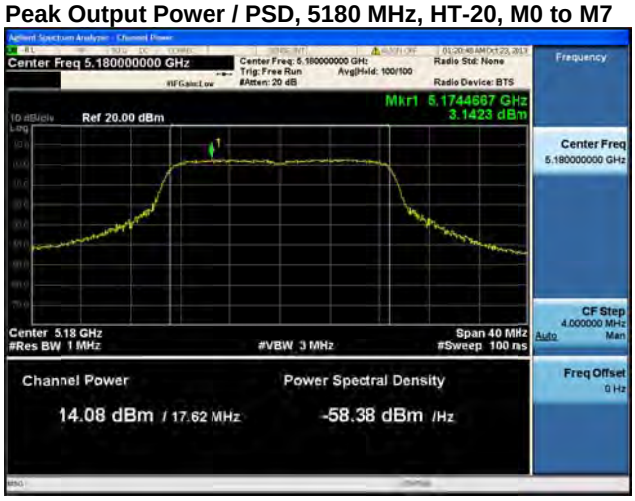



***Antenna A***



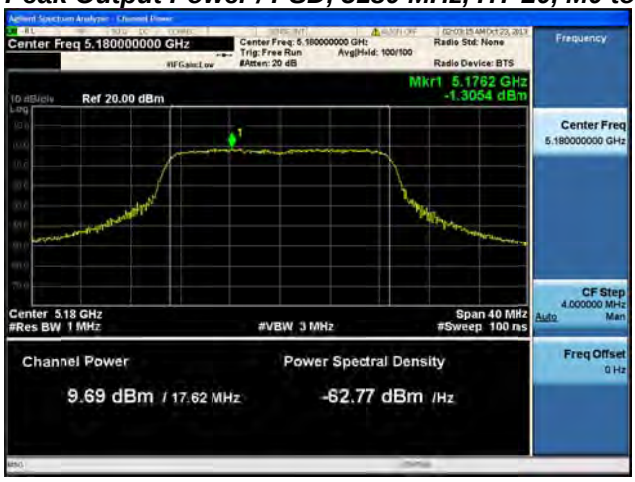

***Antenna B***

**Peak Output Power / PSD, 5180 MHz, HT-20, M0 to M7**




***Antenna A***

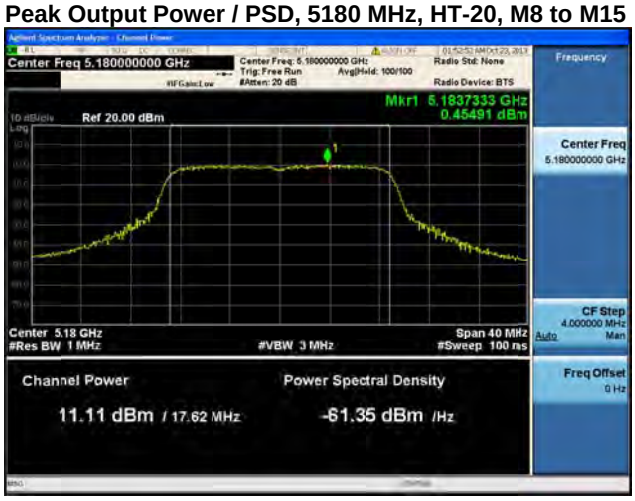
***Peak Output Power / PSD, 5180 MHz, HT-20, M0 to M7***




***Antenna A***


***Antenna B***

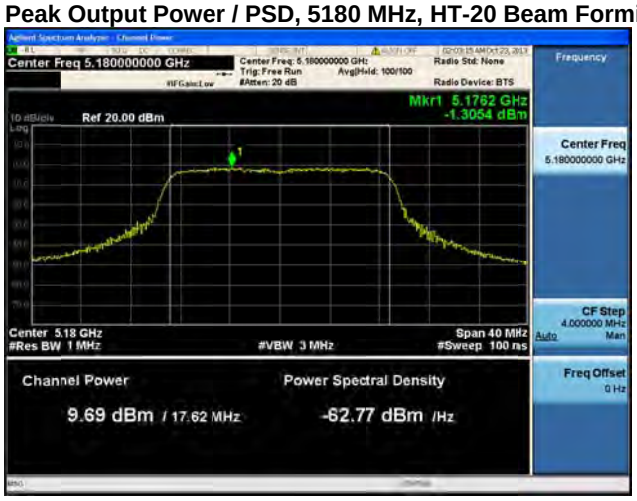
**Peak Output Power / PSD, 5180 MHz, HT-20, M8 to M15**




***Antenna A***


***Antenna B***

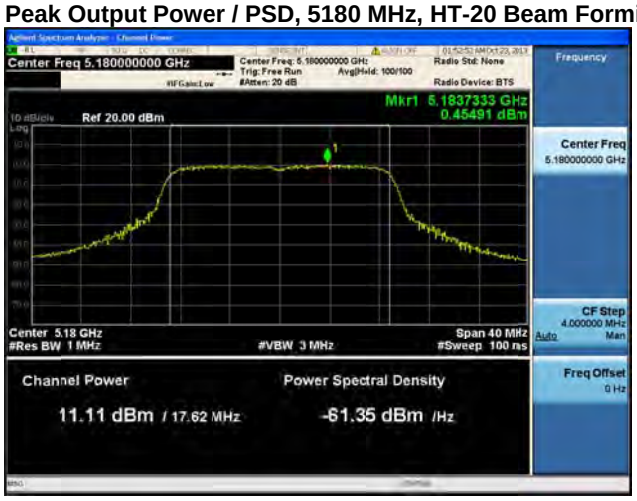
**Peak Output Power / PSD, 5180 MHz, HT-20 Beam Forming, M0 to M7**




***Antenna A***


***Antenna B***

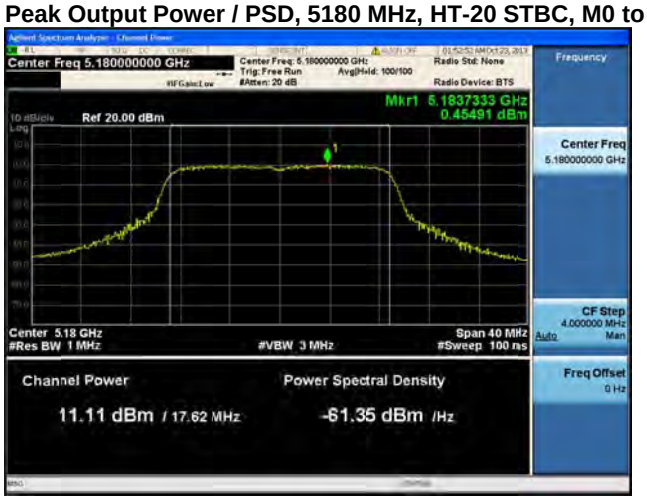
**Peak Output Power / PSD, 5180 MHz, HT-20 Beam Forming, M8 to M15**




***Antenna A***


***Antenna B***

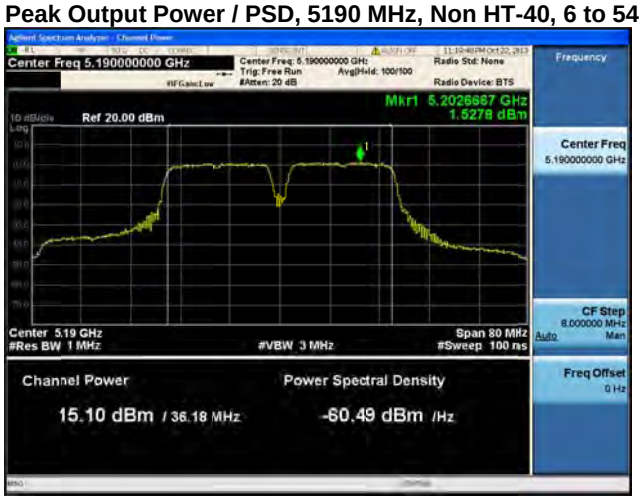
**Peak Output Power / PSD, 5180 MHz, HT-20 STBC, M0 to M7**




***Antenna A***

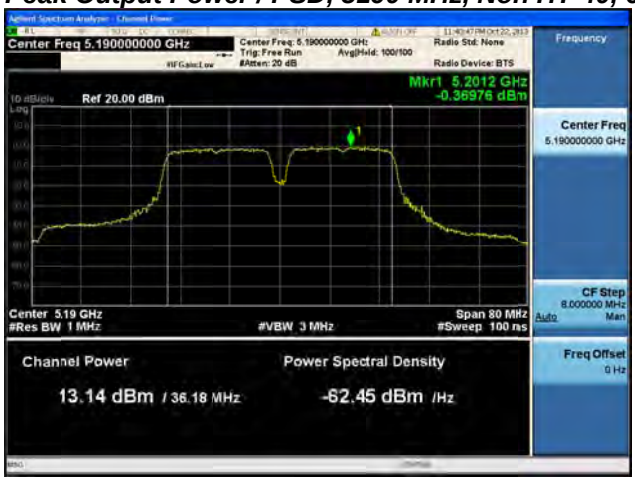

***Antenna B***

**Peak Output Power / PSD, 5190 MHz, Non HT-40, 6 to 54 Mbps**




***Antenna A***

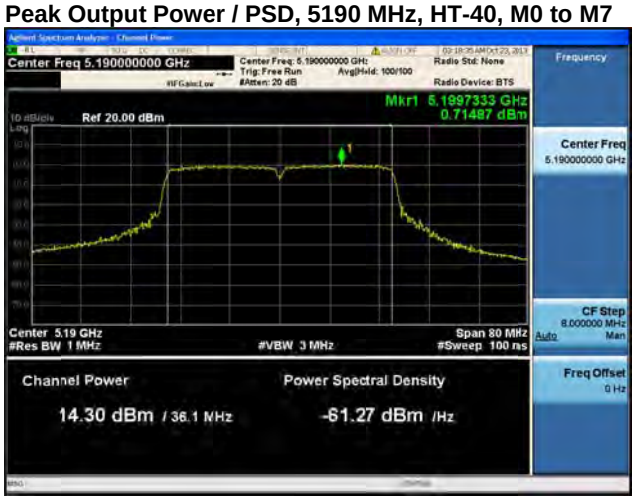
***Peak Output Power / PSD, 5190 MHz, Non HT-40, 6 to 54 Mbps***




***Antenna A***

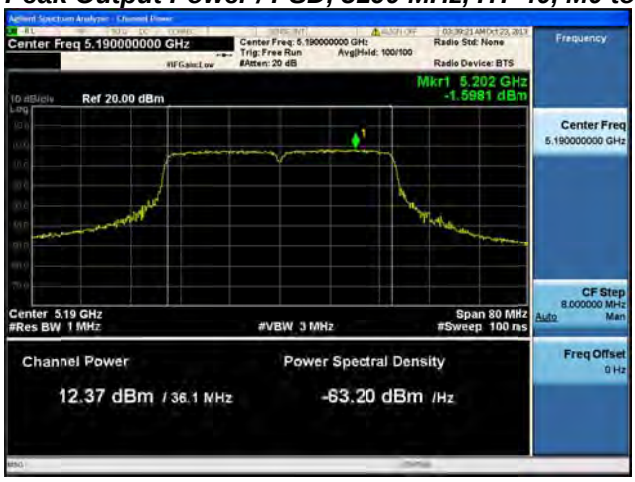

***Antenna B***

**Peak Output Power / PSD, 5190 MHz, HT-40, M0 to M7**




***Antenna A***

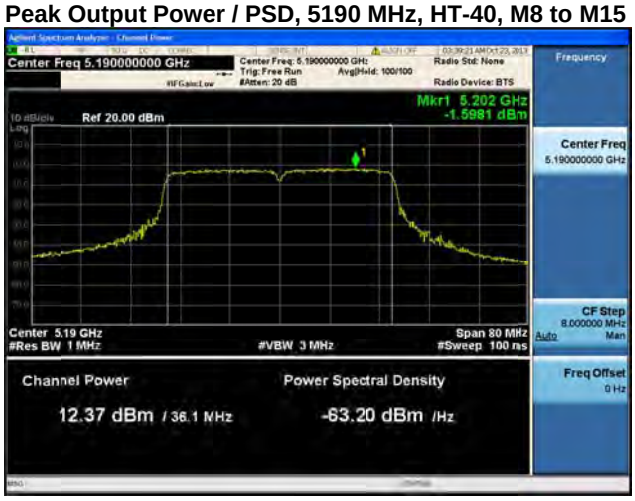
***Peak Output Power / PSD, 5190 MHz, HT-40, M0 to M7***




***Antenna A***


***Antenna B***

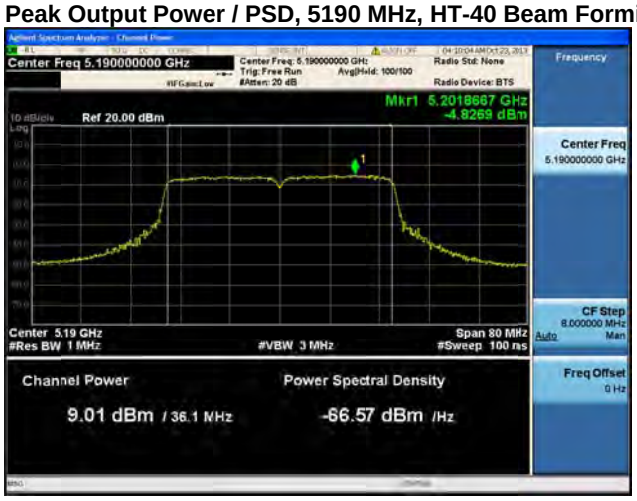
**Peak Output Power / PSD, 5190 MHz, HT-40, M8 to M15**




***Antenna A***


***Antenna B***

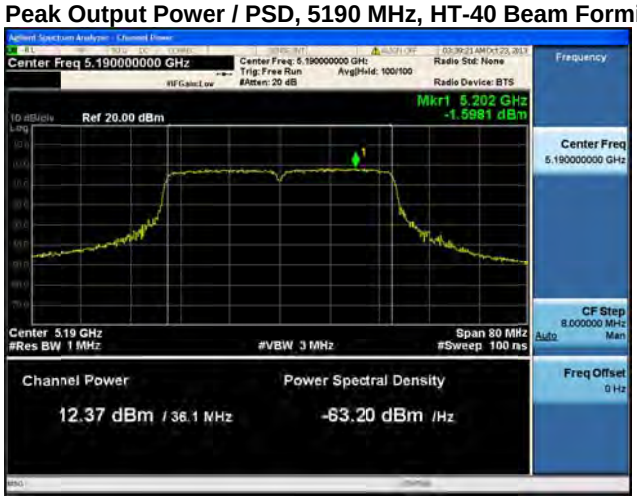
**Peak Output Power / PSD, 5190 MHz, HT-40 Beam Forming, M0 to M7**




***Antenna A***


***Antenna B***

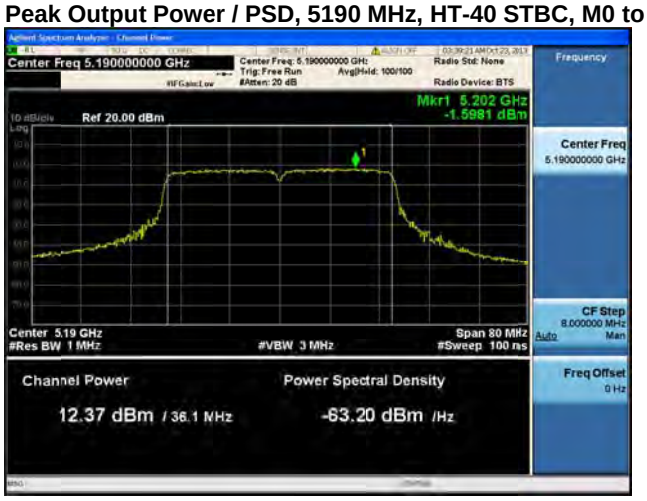
**Peak Output Power / PSD, 5190 MHz, HT-40 Beam Forming, M8 to M15**




***Antenna A***


***Antenna B***

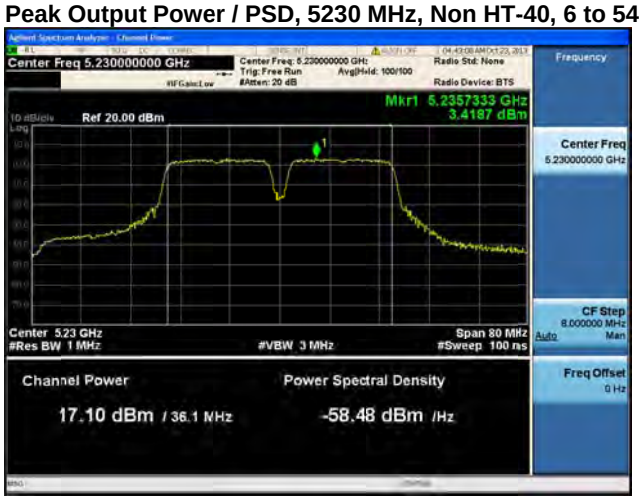
**Peak Output Power / PSD, 5190 MHz, HT-40 STBC, M0 to M7**




***Antenna A***

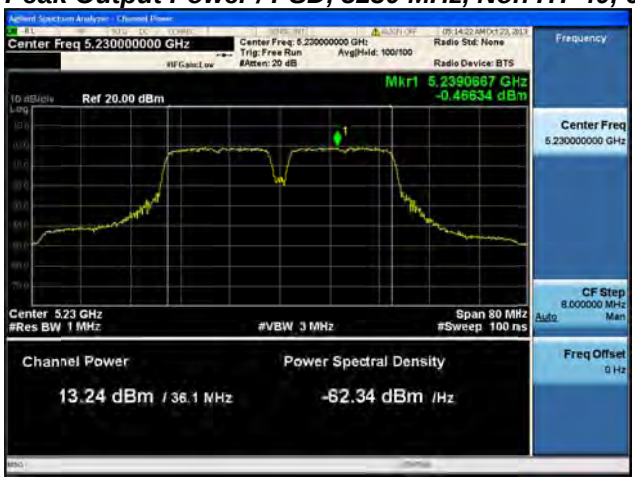

***Antenna B***

**Peak Output Power / PSD, 5230 MHz, Non HT-40, 6 to 54 Mbps**

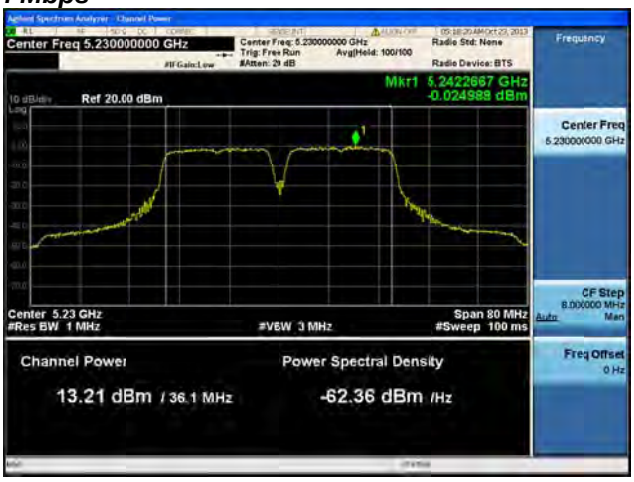



***Antenna A***

***Peak Output Power / PSD, 5230 MHz, Non HT-40, 6 to 54 Mbps***

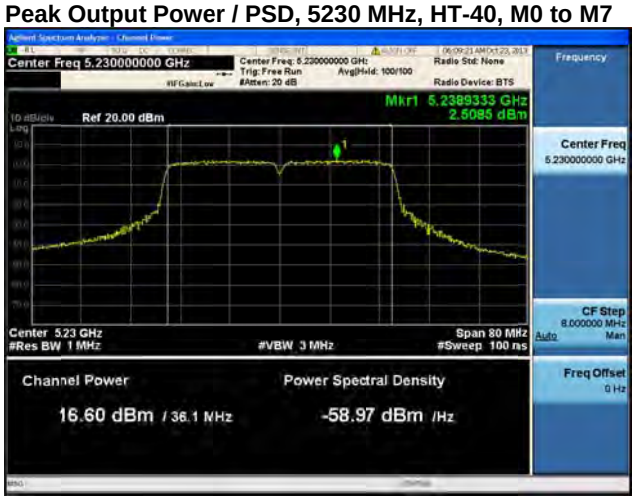



***Antenna A***



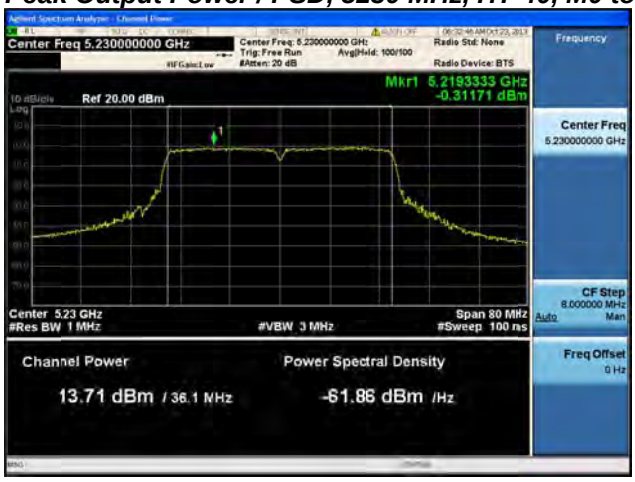

***Antenna B***

**Peak Output Power / PSD, 5230 MHz, HT-40, M0 to M7**




***Antenna A***

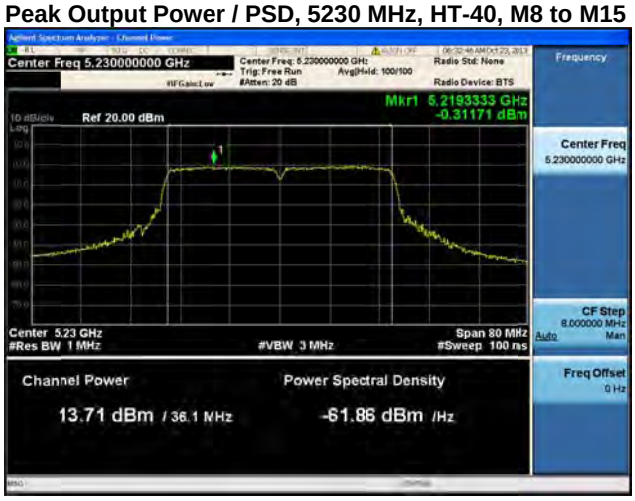
***Peak Output Power / PSD, 5230 MHz, HT-40, M0 to M7***




***Antenna A***


***Antenna B***

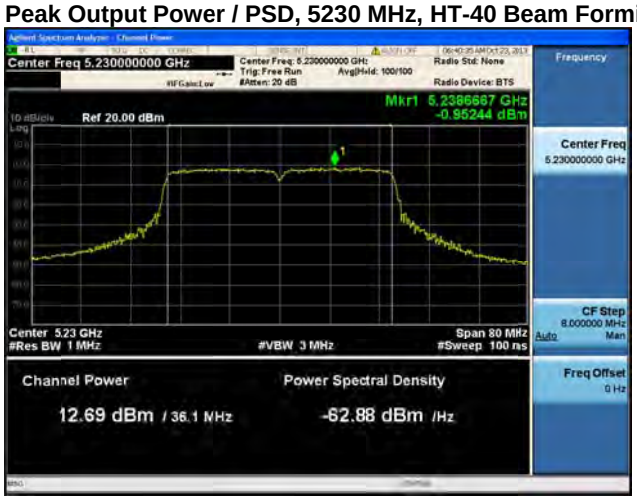
**Peak Output Power / PSD, 5230 MHz, HT-40, M8 to M15**




***Antenna A***


***Antenna B***

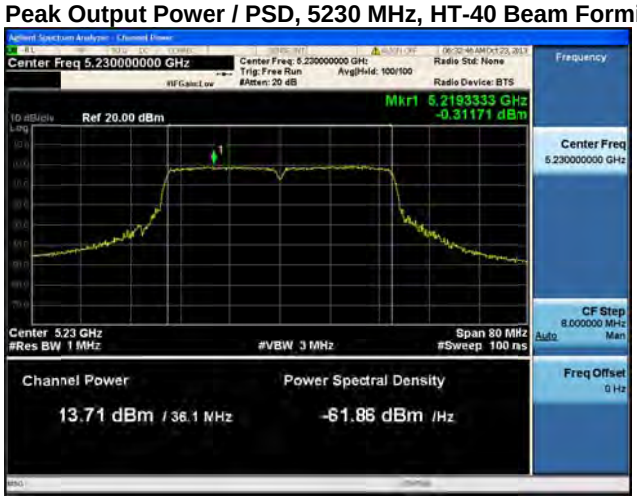
**Peak Output Power / PSD, 5230 MHz, HT-40 Beam Forming, M0 to M7**




***Antenna A***


***Antenna B***

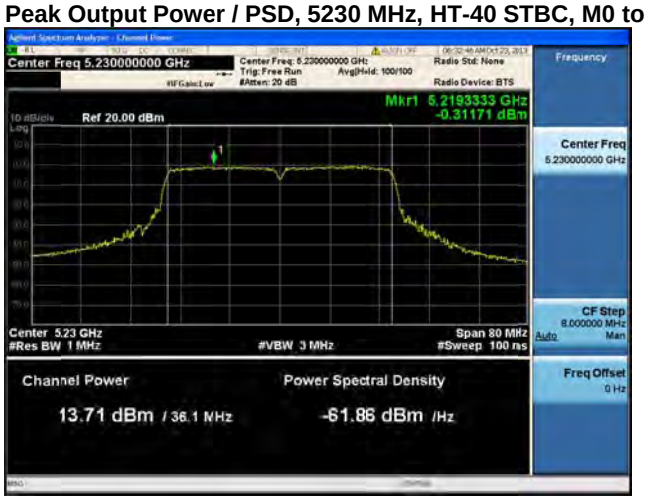
**Peak Output Power / PSD, 5230 MHz, HT-40 Beam Forming, M8 to M15**




***Antenna A***


***Antenna B***

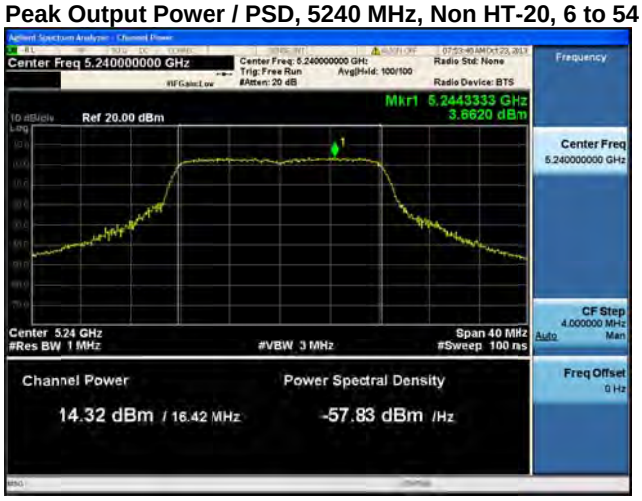
**Peak Output Power / PSD, 5230 MHz, HT-40 STBC, M0 to M7**




***Antenna A***

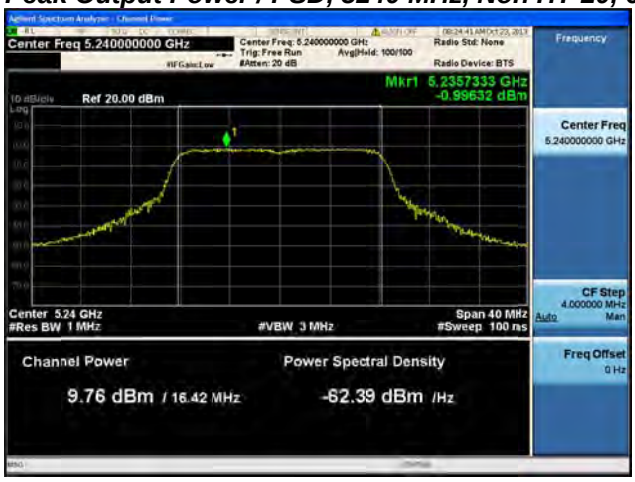

***Antenna B***

**Peak Output Power / PSD, 5240 MHz, Non HT-20, 6 to 54 Mbps**

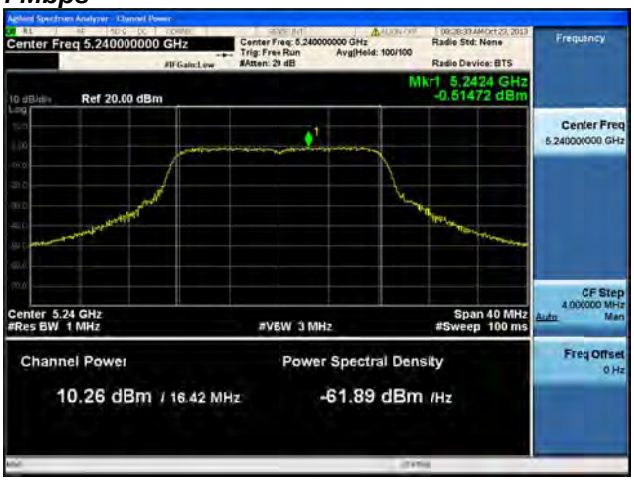



***Antenna A***

***Peak Output Power / PSD, 5240 MHz, Non HT-20, 6 to 54 Mbps***

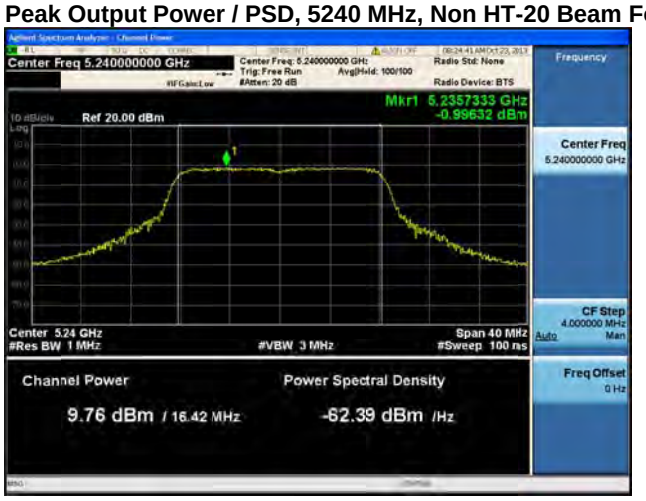



***Antenna A***

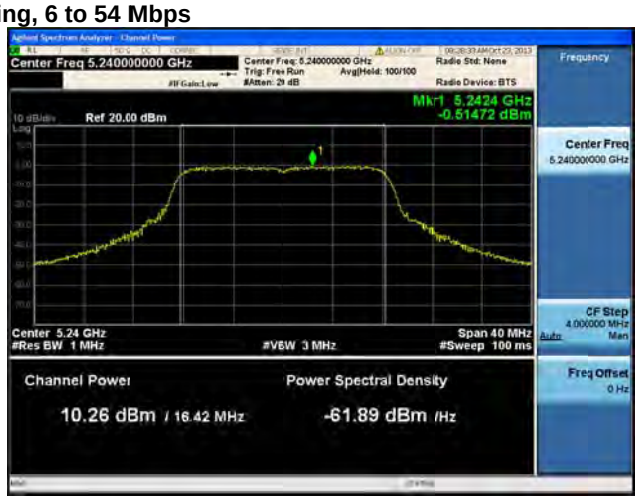



***Antenna B***

**Peak Output Power / PSD, 5240 MHz, Non HT-20 Beam Forming, 6 to 54 Mbps**

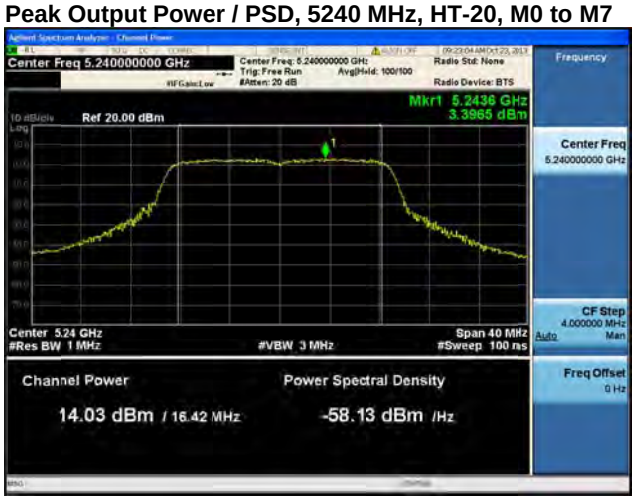



***Antenna A***




***Antenna B***

**Peak Output Power / PSD, 5240 MHz, HT-20, M0 to M7**



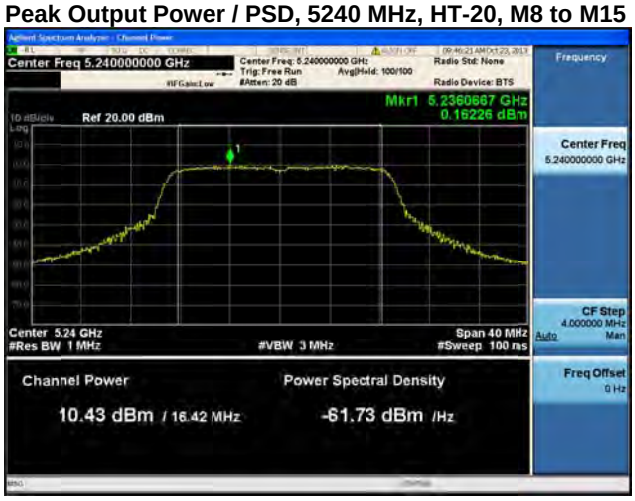

***Antenna A***

***Peak Output Power / PSD, 5240 MHz, HT-20, M0 to M7***


***Antenna A***


***Antenna B***

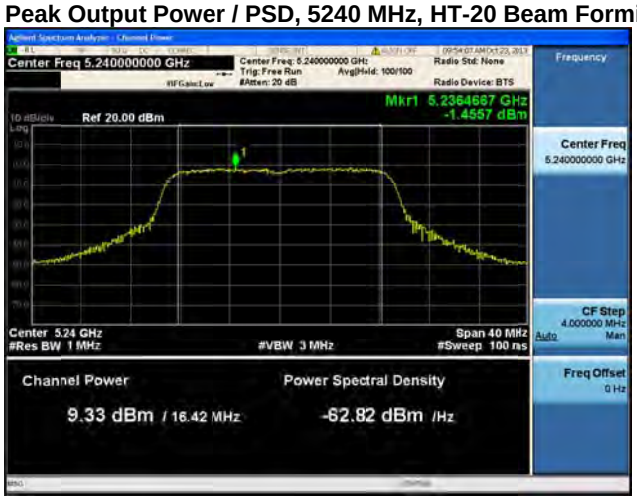
**Peak Output Power / PSD, 5240 MHz, HT-20, M8 to M15**




***Antenna A***


***Antenna B***

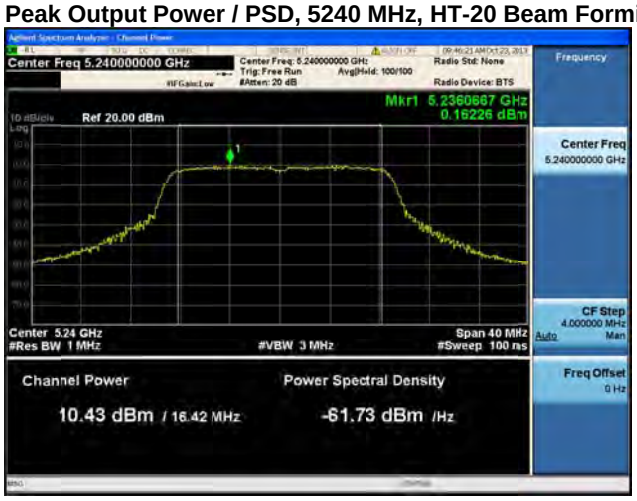
**Peak Output Power / PSD, 5240 MHz, HT-20 Beam Forming, M0 to M7**




***Antenna A***


***Antenna B***

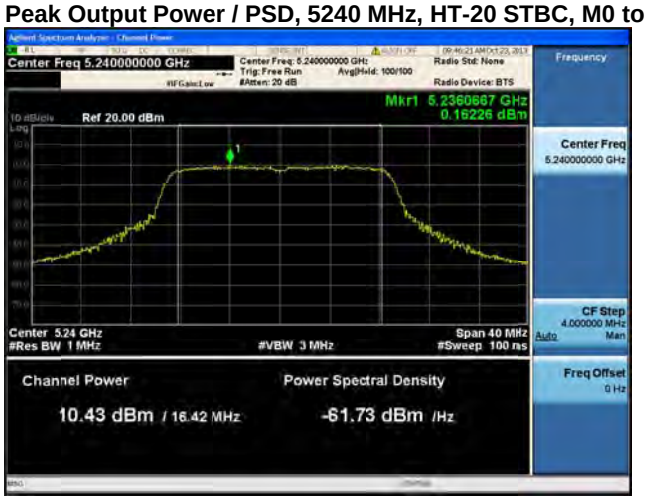
**Peak Output Power / PSD, 5240 MHz, HT-20 Beam Forming, M8 to M15**




***Antenna A***


***Antenna B***

**Peak Output Power / PSD, 5240 MHz, HT-20 STBC, M0 to M7**




***Antenna A***


***Antenna B***

# Peak Excursion

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

Set the spectrum analyzer span to view the entire emission bandwidth. The largest difference between the following two traces must be <= 13 dB for all frequencies across the emission bandwidth.

Set the spectrum analyzer span to view the entire emission bandwidth. The largest difference between the following two traces must be <= 13 dB for all frequencies across the emission bandwidth.

1st Trace: (Peak)

Set Span to encompass the entire emission bandwidth of the signal.
RBW = 1 MHz, VBW = 3 MHz
Detector = Peak
Sweep = 10 s
Trace 1 = Max-hold
Ref Level Offset = correct for attenuator and cable loss
Ref Level = 20dBm
Atten = 10dBm

2nd Trace: (Average)

Trace 2 = clear right
Detector = Sample
Avg/VBW type = Pwr(RMS)
Average = 100
Sweep = single

Set marker Deltas

Trace 1 & Peak search
Marker Delta
Trace 2 & Peak search

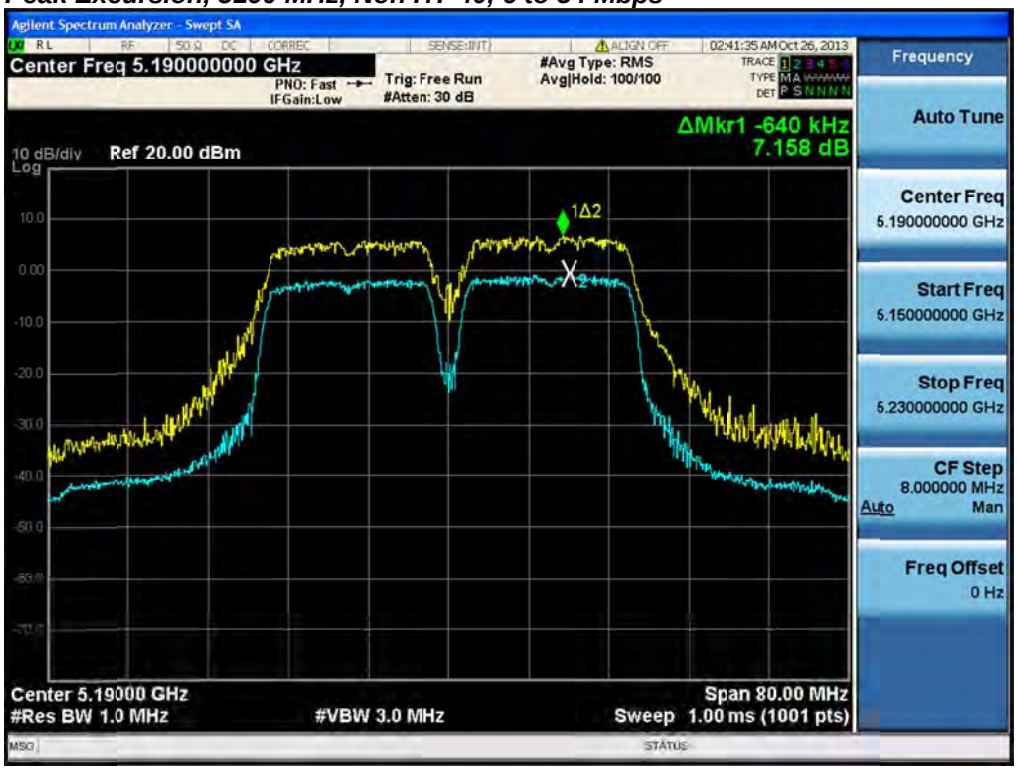
Record the difference between the Peak and Average Markers

| Frequency (MHz) | Mode | Data Rate (Mbps) | Peak Excursion (dB) | Limit (dBm/MHz) | Margin (dB) |
|---|---|---|---|---|---|
| 5180 | Non HT-20, 6 to 54 Mbps | 6 | 7.3 | 13 | 5.7 |
| | HT-20, M0 to M23 | m0 | 7.5 | 13 | 5.5 |
| | | | | | |
| 5190 | Non HT-40, 6 to 54 Mbps | 6 | 7.2 | 13 | 5.8 |
| | HT-40, M0 to M23 | m0 | 7.3 | 13 | 5.7 |
| | | | | | |
| 5230 | Non HT-40, 6 to 54 Mbps | 6 | 7.2 | 13 | 5.8 |
| | HT-40, M0 to M23 | m0 | 7.3 | 13 | 5.7 |
| | | | | | |
| 5240 | Non HT-20, 6 to 54 Mbps | 6 | 7 | 13 | 6.0 |
| | HT-20, M0 to M23 | m0 | 7.3 | 13 | 5.7 |

***Peak Excursion, 5180 MHz, Non HT-20, 6 to 54 Mbps***


***Peak Excursion, 5180 MHz, HT-20, M0 to M23***

***Peak Excursion, 5190 MHz, Non HT-40, 6 to 54 Mbps***




***Peak Excursion, 5190 MHz, HT-40, M0 to M23***

***Peak Excursion, 5230 MHz, Non HT-40, 6 to 54 Mbps***


***Peak Excursion, 5230 MHz, HT-40, M0 to M23***

***Peak Excursion, 5240 MHz, Non HT-20, 6 to 54 Mbps***


***Peak Excursion, 5240 MHz, HT-20, M0 to M23***

# Conducted Spurious Emissions

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

Connect the antenna port(s) to the spectrum analyzer input. Place the radio in continuous transmit mode. Configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer).

| | |
|---|---|
| Span: | 30 MHz-40 GHz |
| Reference Level: | 20 dBm |
| Attenuation: | 10 dB |
| Sweep Time: | 10 s |
| Resolution Bandwidth: | 1 MHz |
| Video Bandwidth: | 3 MHz |
| Detector: | Peak |
| Trace: | Single |
| Marker: | Peak |

Record the marker waveform peak to spur difference

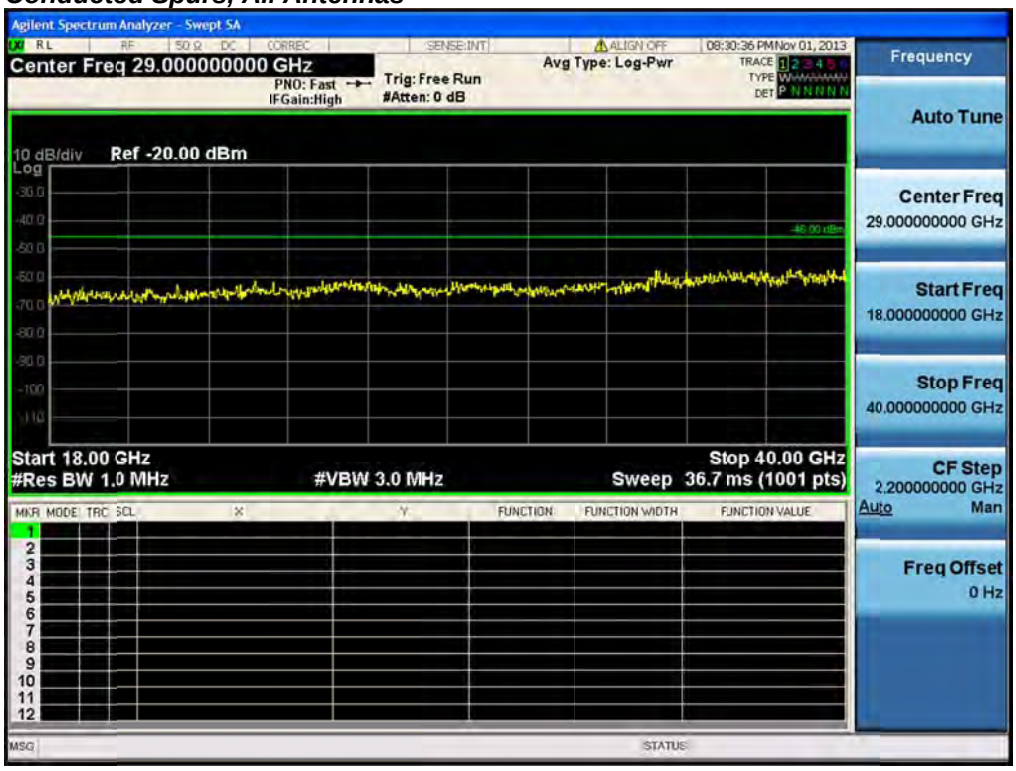
| Frequency (MHz) | Mode | Tx Paths | Correlated Antenna Gain (dBi) | Tx 1 Spur Power (dBm) | Tx 2 Spur Power (dBm) | Total Conducted Spur (dBm) | Limit (dBm) | MargIn (dB) |
|---|---|---|---|---|---|---|---|---|
| 5180 | Non HT-20, 6 to 54 Mbps | 1 | 4 | -58.7 | | -54.7 | -41.25 | 13.5 |
| | Non HT-20, 6 to 54 Mbps | 2 | 4 | -58.8 | -58.8 | -51.8 | -41.25 | 10.5 |
| | Non HT-20 Beam Forming, 6 to 54 Mbps | 2 | 7 | -58.8 | -58.8 | -48.8 | -41.25 | 7.5 |
| | HT-20, M0 to M7 | 1 | 4 | -58.5 | | -54.5 | -41.25 | 13.3 |
| | HT-20, M0 to M7 | 2 | 4 | -58.8 | -58.9 | -51.8 | -41.25 | 10.6 |
| | HT-20, M8 to M15 | 2 | 4 | -58.7 | -58.8 | -51.7 | -41.25 | 10.5 |
| | HT-20 Beam Forming, M0 to M7 | 2 | 7 | -58.8 | -58.9 | -48.8 | -41.25 | 7.6 |
| | HT-20 Beam Forming, M8 to M15 | 2 | 4 | -58.7 | -58.8 | -51.7 | -41.25 | 10.5 |
| | HT-20 STBC, M0 to M7 | 2 | 4 | -58.7 | -58.8 | -51.7 | -41.25 | 10.5 |
| | | | | | | | | |
| 5190 | Non HT-40, 6 to 54 Mbps | 1 | 4 | -58.6 | | -54.6 | -41.25 | 13.4 |
| | Non HT-40, 6 to 54 Mbps | 2 | 4 | -58.8 | -58.8 | -51.8 | -41.25 | 10.5 |
| | HT-40, M0 to M7 | 1 | 4 | -58.8 | | -54.8 | -41.25 | 13.6 |
| | HT-40, M0 to M7 | 2 | 4 | -58.3 | -58.6 | -51.4 | -41.25 | 10.2 |
| | HT-40, M8 to M15 | 2 | 4 | -58.3 | -58.6 | -51.4 | -41.25 | 10.2 |
| | HT-40 Beam Forming, M0 to M7 | 2 | 7 | -58.7 | -58.7 | -48.7 | -41.25 | 7.4 |
| | HT-40 Beam Forming, M8 to M15 | 2 | 4 | -58.3 | -58.6 | -51.4 | -41.25 | 10.2 |
| | HT-40 STBC, M0 to M7 | 2 | 4 | -58.3 | -58.6 | -51.4 | -41.25 | 10.2 |
| | | | | | | | | |
| 5230 | Non HT-40, 6 to 54 Mbps | 1 | 4 | -58.8 | | -54.8 | -41.25 | 13.6 |
| | Non HT-40, 6 to 54 Mbps | 2 | 4 | -58.9 | -59.0 | -51.9 | -41.25 | 10.7 |
| | HT-40, M0 to M7 | 1 | 4 | -58.7 | | -54.7 | -41.25 | 13.5 |
| | HT-40, M0 to M7 | 2 | 4 | -58.8 | -58.9 | -51.8 | -41.25 | 10.6 |
| | HT-40, M8 to M15 | 2 | 4 | -58.8 | -58.9 | -51.8 | -41.25 | 10.6 |
| | HT-40 Beam Forming, M0 to M7 | 2 | 7 | -58.8 | -59.0 | -48.9 | -41.25 | 7.6 |
| | HT-40 Beam Forming, M8 to M15 | 2 | 4 | -58.8 | -58.9 | -51.8 | -41.25 | 10.6 |
| | HT-40 STBC, M0 to M7 | 2 | 4 | -58.8 | -58.9 | -51.8 | -41.25 | 10.6 |
| | | | | | | | | |
| 5240 | Non HT-20, 6 to 54 Mbps | 1 | 4 | -58.9 | | -54.9 | -41.25 | 13.7 |
| | Non HT-20, 6 to 54 Mbps | 2 | 4 | -58.9 | -59.0 | -51.9 | -41.25 | 10.7 |
| | Non HT-20 Beam Forming, 6 to 54 Mbps | 2 | 7 | -58.9 | -59.0 | -48.9 | -41.25 | 7.7 |
| | HT-20, M0 to M7 | 1 | 4 | -58.8 | | -54.8 | -41.25 | 13.6 |
| | HT-20, M0 to M7 | 2 | 4 | -58.7 | -58.8 | -51.7 | -41.25 | 10.5 |
| | HT-20, M8 to M15 | 2 | 4 | -58.9 | -58.9 | -51.9 | -41.25 | 10.6 |
| | HT-20 Beam Forming, M0 to M7 | 2 | 7 | -58.7 | -58.8 | -48.7 | -41.25 | 7.5 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | HT-20 Beam Forming, M8 to M15 | 2 | 4 | -58.9 | -58.9 | -51.9 | -41.25 | 10.6 |
| | HT-20 STBC, M0 to M7 | 2 | 4 | -58.9 | -58.9 | -51.9 | -41.25 | 10.6 |

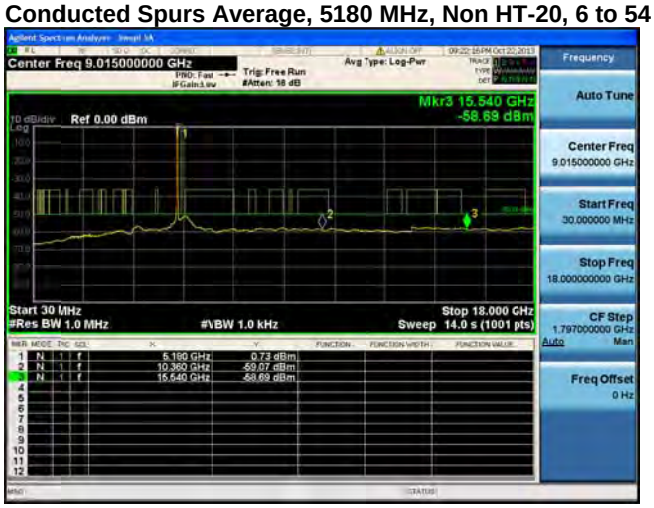
| Frequency (MHz) | Mode | Tx Paths | Correlated Antenna Gain (dBi) | Tx 1 Spur Power (dBm) | Tx 2 Spur Power (dBm) | Total Conducted Spur (dBm) | Limit (dBm) | MargIn (dB) |
|---|---|---|---|---|---|---|---|---|
| 5180 | Non HT-20, 6 to 54 Mbps | 1 | 4 | -62.9 | | -58.9 | -27 | 31.9 |
| | Non HT-20, 6 to 54 Mbps | 2 | 4 | -63.8 | -63.7 | -56.7 | -27 | 29.7 |
| | Non HT-20 Beam Forming, 6 to 54 Mbps | 2 | 7 | -63.8 | -63.7 | -53.7 | -27 | 26.7 |
| | HT-20, M0 to M7 | 1 | 4 | -63.0 | | -59.0 | -27 | 32.0 |
| | HT-20, M0 to M7 | 2 | 4 | -62.0 | -62.6 | -55.3 | -27 | 28.3 |
| | HT-20, M8 to M15 | 2 | 4 | -62.2 | -64.0 | -56.0 | -27 | 29.0 |
| | HT-20 Beam Forming, M0 to M7 | 2 | 7 | -62.0 | -62.6 | -52.3 | -27 | 25.3 |
| | HT-20 Beam Forming, M8 to M15 | 2 | 4 | -62.2 | -64.0 | -56.0 | -27 | 29.0 |
| | HT-20 STBC, M0 to M7 | 2 | 4 | -62.2 | -64.0 | -56.0 | -27 | 29.0 |
| | | | | | | | | |
| 5190 | Non HT-40, 6 to 54 Mbps | 1 | 4 | -61.5 | | -57.5 | -27 | 30.5 |
| | Non HT-40, 6 to 54 Mbps | 2 | 4 | -60.8 | -63.1 | -54.8 | -27 | 27.8 |
| | HT-40, M0 to M7 | 1 | 4 | -63.0 | | -59.0 | -27 | 32.0 |
| | HT-40, M0 to M7 | 2 | 4 | -63.9 | -61.6 | -55.6 | -27 | 28.6 |
| | HT-40, M8 to M15 | 2 | 4 | -63.9 | -61.6 | -55.6 | -27 | 28.6 |
| | HT-40 Beam Forming, M0 to M7 | 2 | 7 | -62.0 | -61.3 | -51.6 | -27 | 24.6 |
| | HT-40 Beam Forming, M8 to M15 | 2 | 4 | -63.9 | -61.6 | -55.6 | -27 | 28.6 |
| | HT-40 STBC, M0 to M7 | 2 | 4 | -63.9 | -61.6 | -55.6 | -27 | 28.6 |
| | | | | | | | | |
| 5230 | Non HT-40, 6 to 54 Mbps | 1 | 4 | -61.8 | | -57.8 | -27 | 30.8 |
| | Non HT-40, 6 to 54 Mbps | 2 | 4 | -62.5 | -64.6 | -56.4 | -27 | 29.4 |
| | HT-40, M0 to M7 | 1 | 4 | -63.4 | | -59.4 | -27 | 32.4 |
| | HT-40, M0 to M7 | 2 | 4 | -62.0 | -63.0 | -55.5 | -27 | 28.5 |
| | HT-40, M8 to M15 | 2 | 4 | -62.0 | -63.0 | -55.5 | -27 | 28.5 |
| | HT-40 Beam Forming, M0 to M7 | 2 | 7 | -63.8 | -63.4 | -53.6 | -27 | 26.6 |
| | HT-40 Beam Forming, M8 to M15 | 2 | 4 | -62.0 | -63.0 | -55.5 | -27 | 28.5 |
| | HT-40 STBC, M0 to M7 | 2 | 4 | -62.0 | -63.0 | -55.5 | -27 | 28.5 |
| | | | | | | | | |
| 5240 | Non HT-20, 6 to 54 Mbps | 1 | 4 | -63.3 | | -59.3 | -27 | 32.3 |
| | Non HT-20, 6 to 54 Mbps | 2 | 4 | -62.3 | -62.6 | -55.4 | -27 | 28.4 |
| | Non HT-20 Beam Forming, 6 to 54 Mbps | 2 | 7 | -62.3 | -62.6 | -52.4 | -27 | 25.4 |
| | HT-20, M0 to M7 | 1 | 4 | -62.7 | | -58.7 | -27 | 31.7 |
| | HT-20, M0 to M7 | 2 | 4 | -62.8 | -63.6 | -56.2 | -27 | 29.2 |
| | HT-20, M8 to M15 | 2 | 4 | -61.0 | -62.4 | -54.6 | -27 | 27.6 |
| | HT-20 Beam Forming, M0 to M7 | 2 | 7 | -62.8 | -63.6 | -53.2 | -27 | 26.2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | HT-20 Beam Forming, M8 to M15 | 2 | 4 | -61.0 | -62.4 | -54.6 | -27 | 27.6 |
| | HT-20 STBC, M0 to M7 | 2 | 4 | -61.0 | -62.4 | -54.6 | -27 | 27.6 |

***Conducted Spurs, All Antennas***

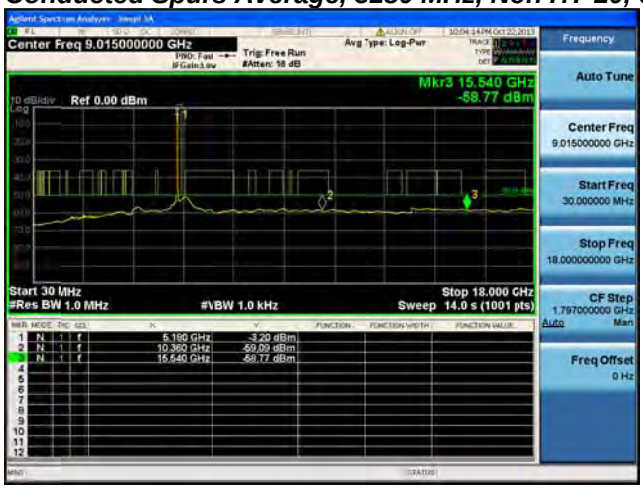


**Conducted Spurs Average, 5180 MHz, Non HT-20, 6 to 54 Mbps**




***Antenna A***

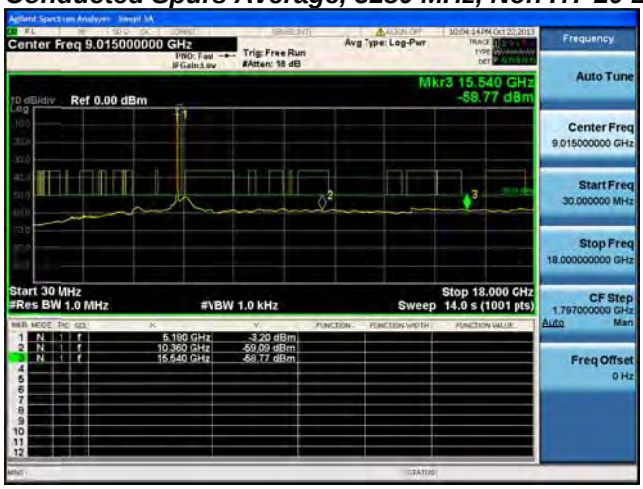
***Conducted Spurs Average, 5180 MHz, Non HT-20, 6 to 54 Mbps***




***Antenna A***


***Antenna B***

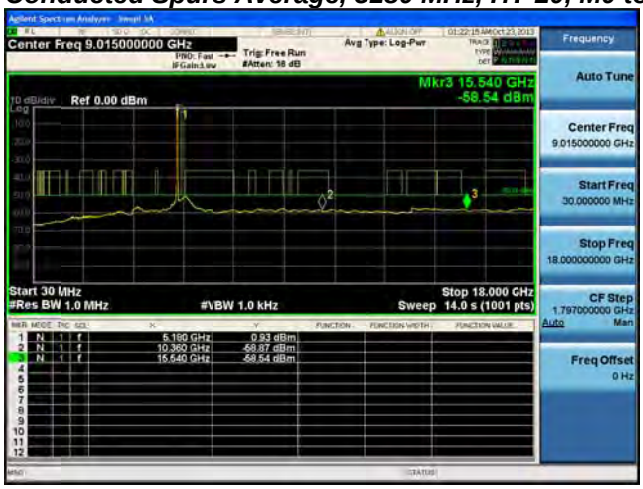
***Conducted Spurs Average, 5180 MHz, Non HT-20 Beam Forming, 6 to 54 Mbps***




***Antenna A***


***Antenna B***

***Conducted Spurs Average, 5180 MHz, HT-20, M0 to M7***




***Antenna A***

***Conducted Spurs Average, 5180 MHz, HT-20, M0 to M7***


***Antenna A***


***Antenna B***

***Conducted Spurs Average, 5180 MHz, HT-20, M8 to M15***


***Antenna A***


***Antenna B***

***Conducted Spurs Average, 5180 MHz, HT-20 Beam Forming, M0 to M7***


***Antenna A***


***Antenna B***

***Conducted Spurs Average, 5180 MHz, HT-20 Beam Forming, M8 to M15***


***Antenna A***


***Antenna B***

***Conducted Spurs Average, 5180 MHz, HT-20 STBC, M0 to M7***

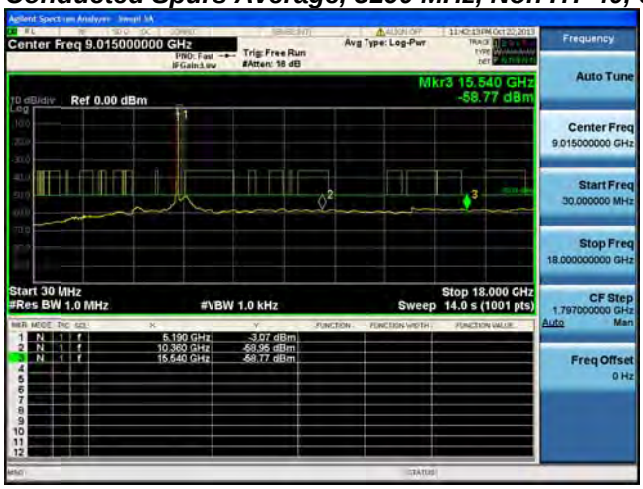

***Antenna A***


***Antenna B***

***Conducted Spurs Average, 5190 MHz, Non HT-40, 6 to 54 Mbps***


***Antenna A***

***Conducted Spurs Average, 5190 MHz, Non HT-40, 6 to 54 Mbps***




***Antenna A***


***Antenna B***

***Conducted Spurs Average, 5190 MHz, HT-40, M0 to M7***


***Antenna A***

***Conducted Spurs Average, 5190 MHz, HT-40, M0 to M7***


***Antenna A***


***Antenna B***

***Conducted Spurs Average, 5190 MHz, HT-40, M8 to M15***


***Antenna A***


***Antenna B***

***Conducted Spurs Average, 5190 MHz, HT-40 Beam Forming, M0 to M7***


***Antenna A***


***Antenna B***

***Conducted Spurs Average, 5190 MHz, HT-40 Beam Forming, M8 to M15***


***Antenna A***


***Antenna B***

***Conducted Spurs Average, 5190 MHz, HT-40 STBC, M0 to M7***

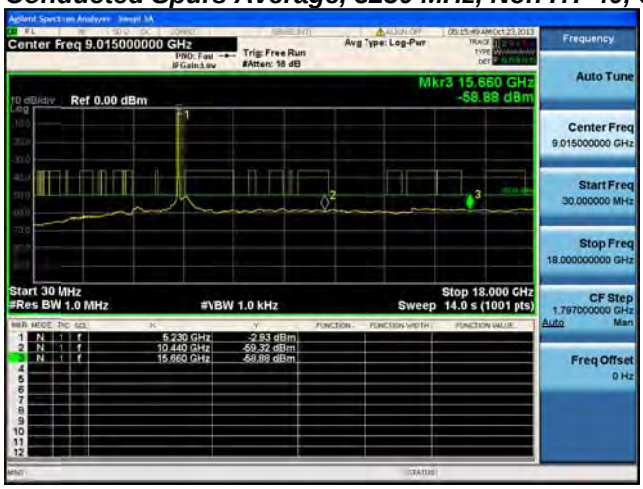

***Antenna A***


***Antenna B***

***Conducted Spurs Average, 5230 MHz, Non HT-40, 6 to 54 Mbps***


***Antenna A***

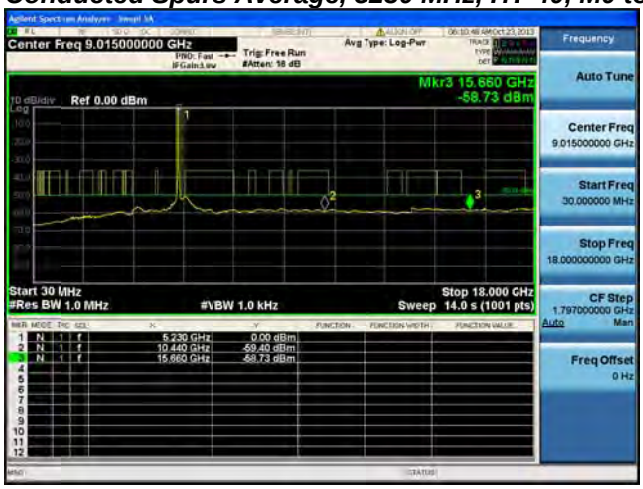
***Conducted Spurs Average, 5230 MHz, Non HT-40, 6 to 54 Mbps***




***Antenna A***

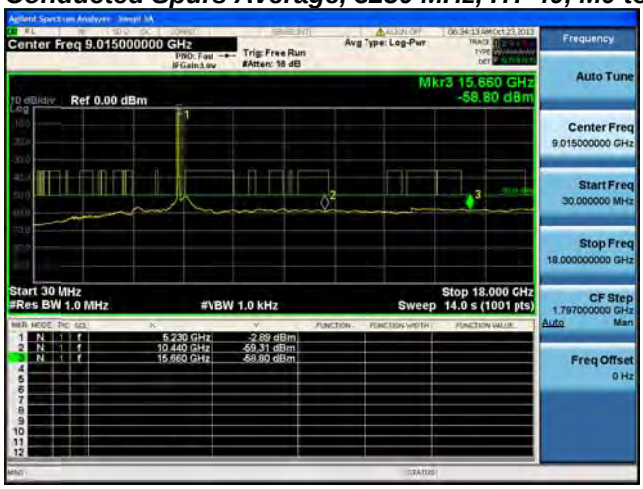

***Antenna B***

***Conducted Spurs Average, 5230 MHz, HT-40, M0 to M7***




***Antenna A***

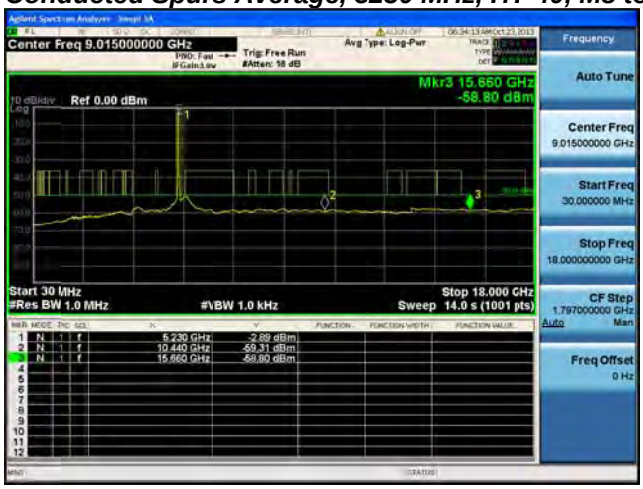
***Conducted Spurs Average, 5230 MHz, HT-40, M0 to M7***




***Antenna A***


***Antenna B***

***Conducted Spurs Average, 5230 MHz, HT-40, M8 to M15***




***Antenna A***

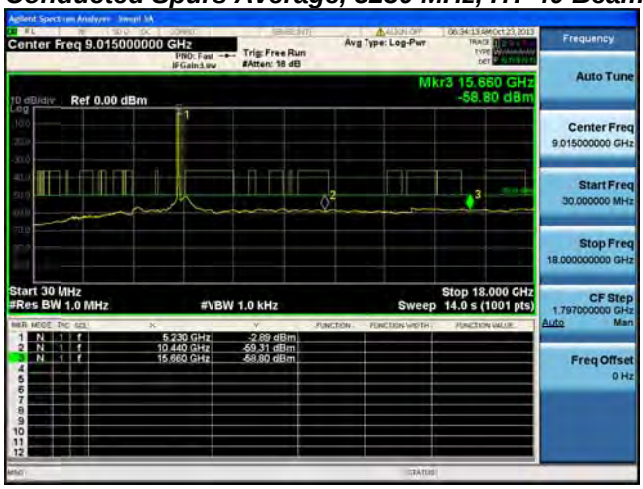

***Antenna B***

***Conducted Spurs Average, 5230 MHz, HT-40 Beam Forming, M0 to M7***


***Antenna A***


***Antenna B***

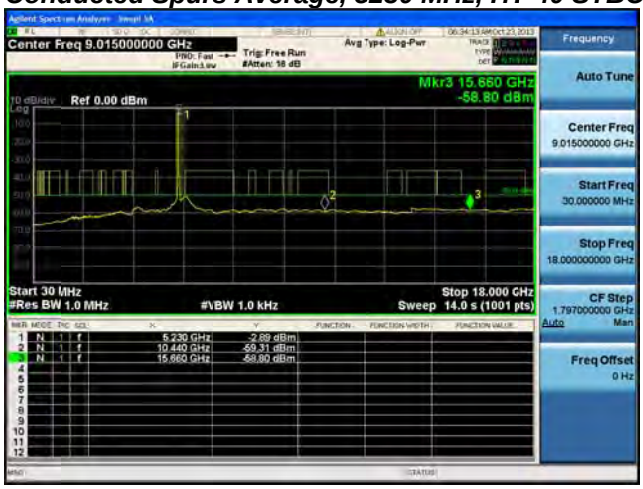
***Conducted Spurs Average, 5230 MHz, HT-40 Beam Forming, M8 to M15***




***Antenna A***


***Antenna B***

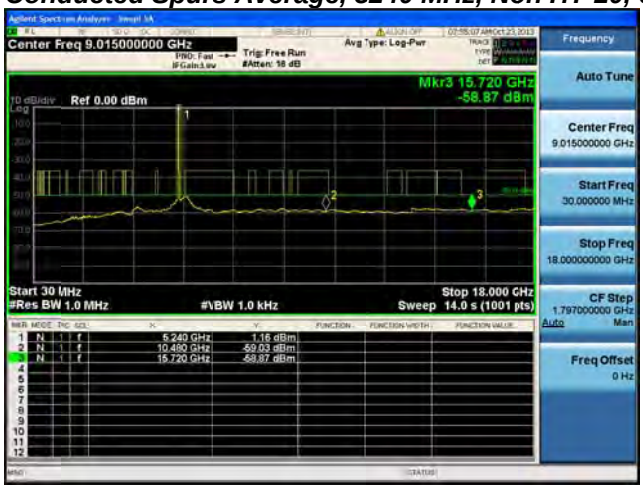
***Conducted Spurs Average, 5230 MHz, HT-40 STBC, M0 to M7***




***Antenna A***

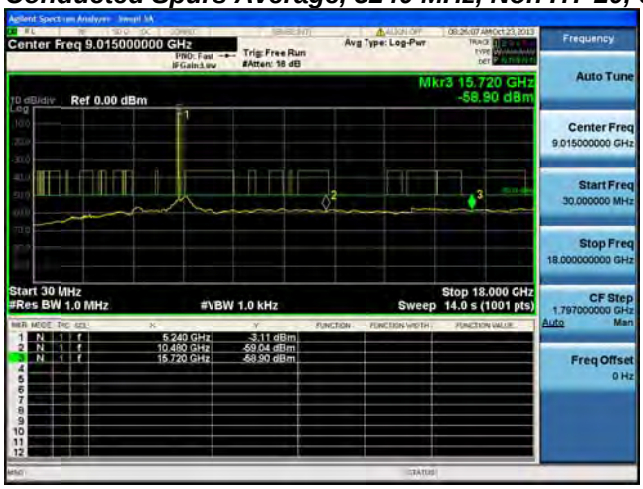

***Antenna B***

***Conducted Spurs Average, 5240 MHz, Non HT-20, 6 to 54 Mbps***




***Antenna A***

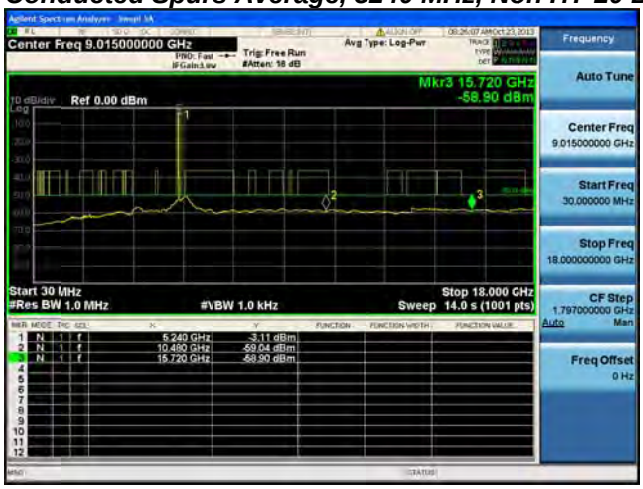
***Conducted Spurs Average, 5240 MHz, Non HT-20, 6 to 54 Mbps***




***Antenna A***


***Antenna B***

***Conducted Spurs Average, 5240 MHz, Non HT-20 Beam Forming, 6 to 54 Mbps***



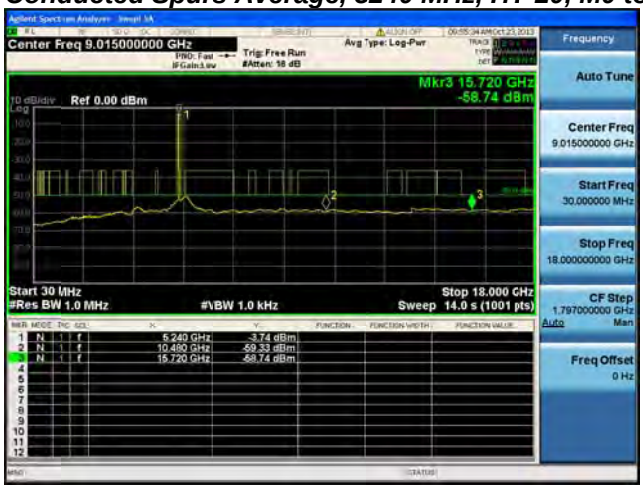

***Antenna A***


***Antenna B***

***Conducted Spurs Average, 5240 MHz, HT-20, M0 to M7***


***Antenna A***

***Conducted Spurs Average, 5240 MHz, HT-20, M0 to M7***




***Antenna A***

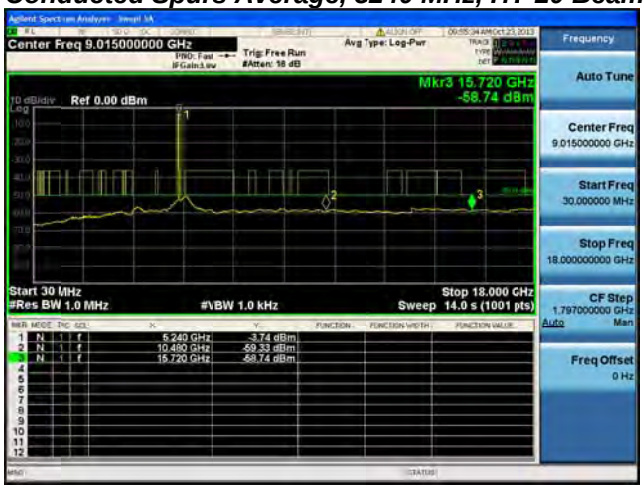

***Antenna B***

***Conducted Spurs Average, 5240 MHz, HT-20, M8 to M15***


***Antenna A***


***Antenna B***

***Conducted Spurs Average, 5240 MHz, HT-20 Beam Forming, M0 to M7***




***Antenna A***


***Antenna B***

***Conducted Spurs Average, 5240 MHz, HT-20 Beam Forming, M8 to M15***


***Antenna A***

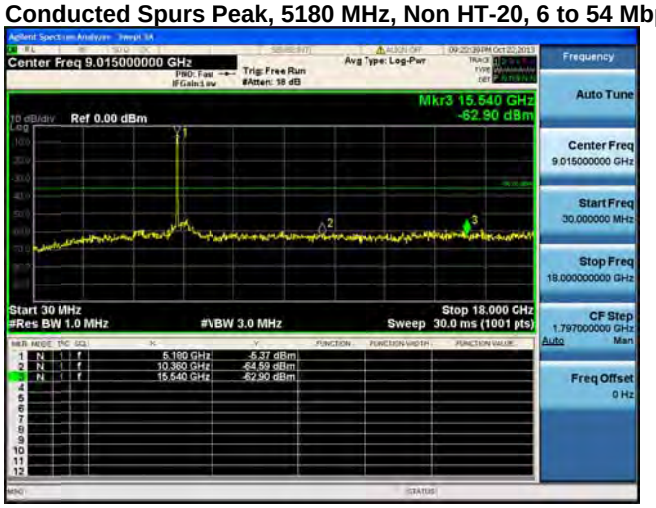

***Antenna B***

***Conducted Spurs Average, 5240 MHz, HT-20 STBC, M0 to M7***


***Antenna A***

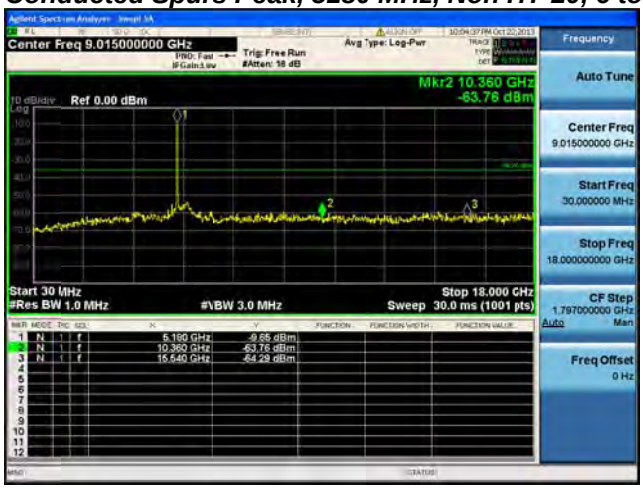

***Antenna B***

**Conducted Spurs Peak, 5180 MHz, Non HT-20, 6 to 54 Mbps**

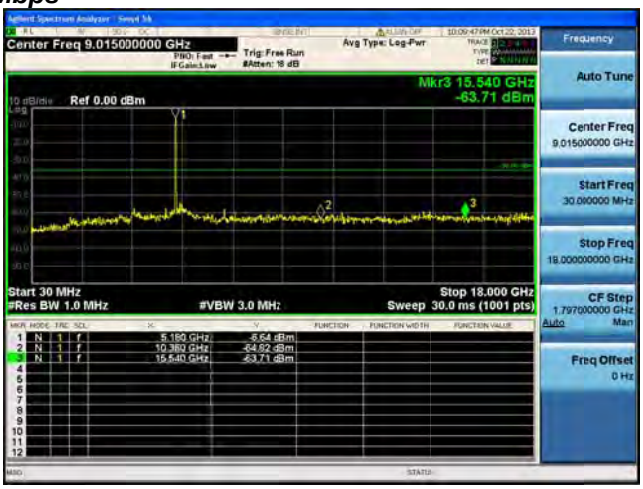



***Antenna A***

***Conducted Spurs Peak, 5180 MHz, Non HT-20, 6 to 54 Mbps***

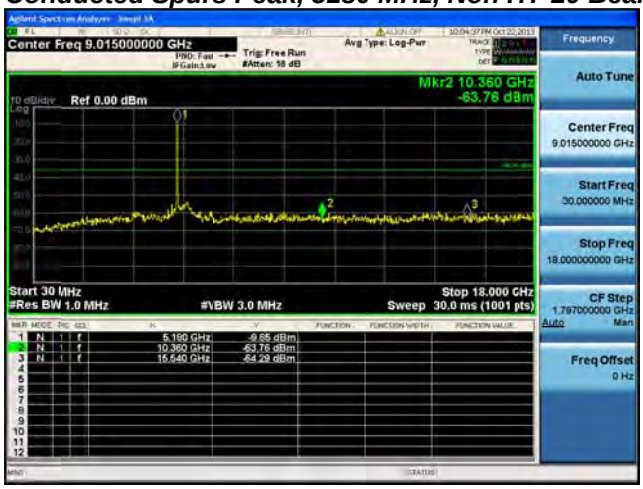



***Antenna A***

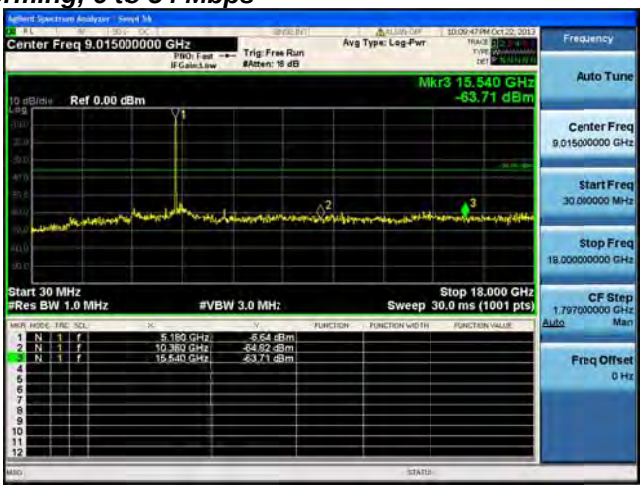



***Antenna B***

***Conducted Spurs Peak, 5180 MHz, Non HT-20 Beam Forming, 6 to 54 Mbps***

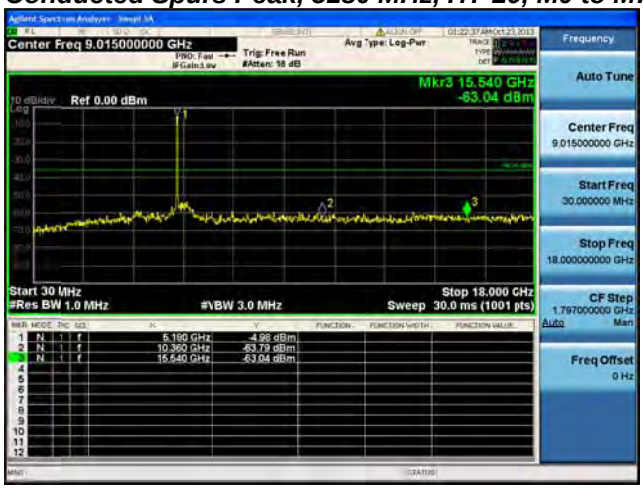



***Antenna A***



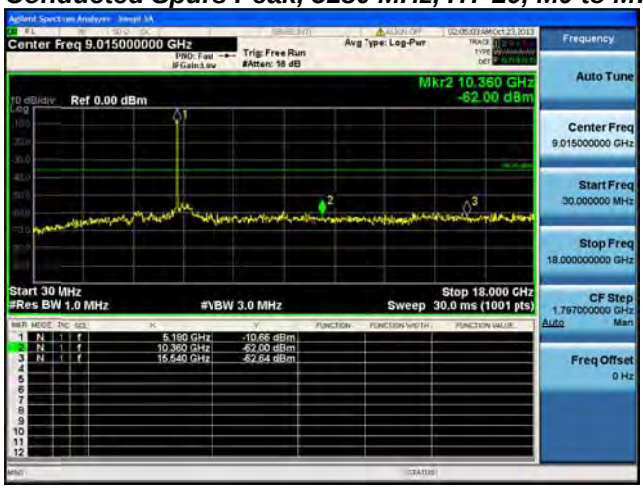

***Antenna B***

***Conducted Spurs Peak, 5180 MHz, HT-20, M0 to M7***

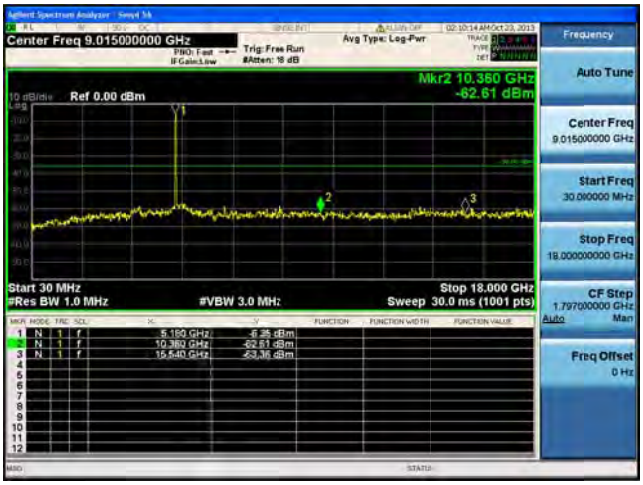



***Antenna A***

***Conducted Spurs Peak, 5180 MHz, HT-20, M0 to M7***

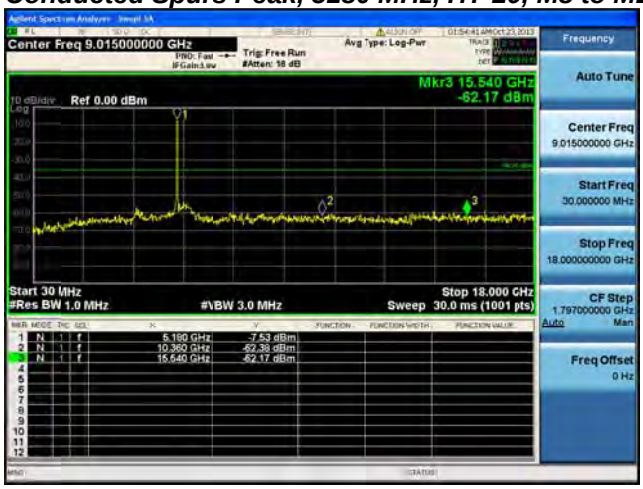



***Antenna A***

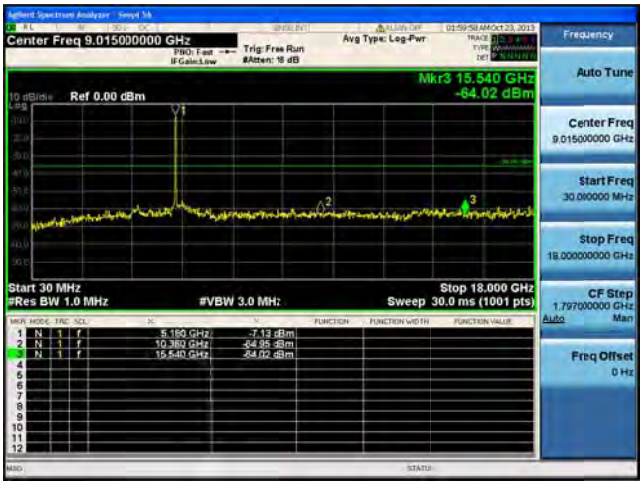



***Antenna B***

***Conducted Spurs Peak, 5180 MHz, HT-20, M8 to M15***

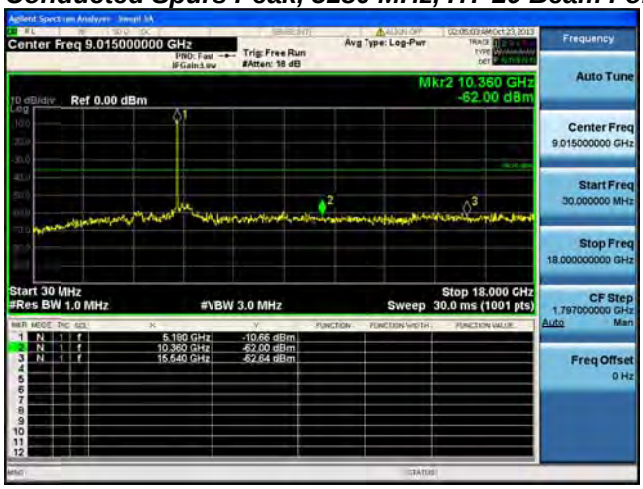



***Antenna A***

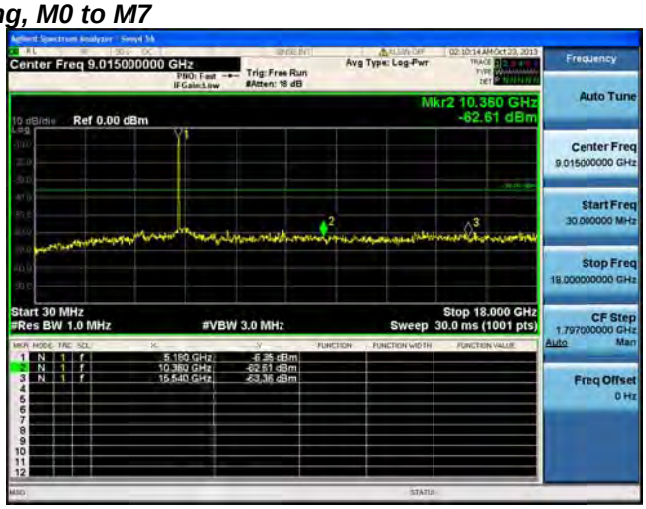



***Antenna B***

***Conducted Spurs Peak, 5180 MHz, HT-20 Beam Forming, M0 to M7***

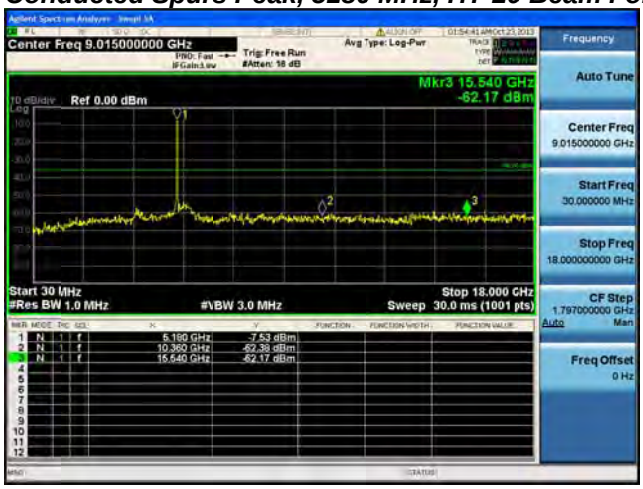



***Antenna A***

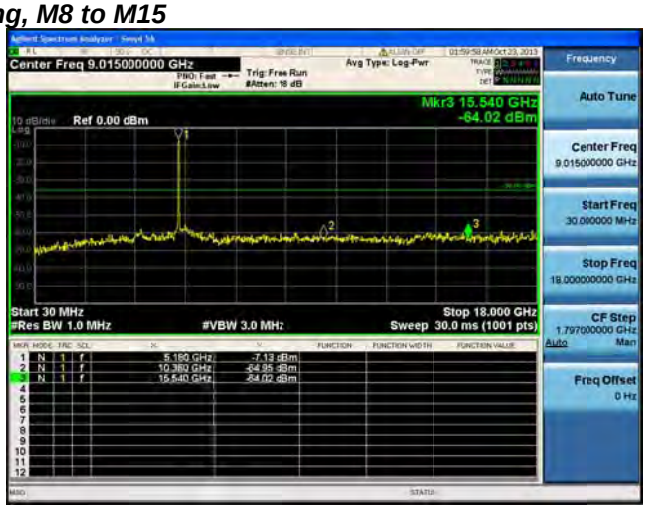



***Antenna B***

***Conducted Spurs Peak, 5180 MHz, HT-20 Beam Forming, M8 to M15***

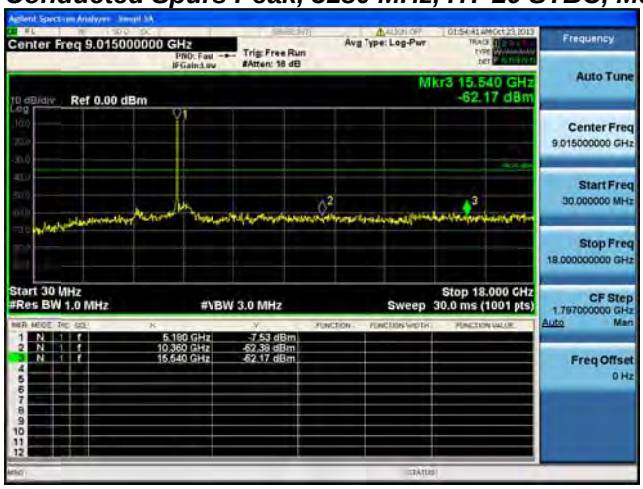



***Antenna A***

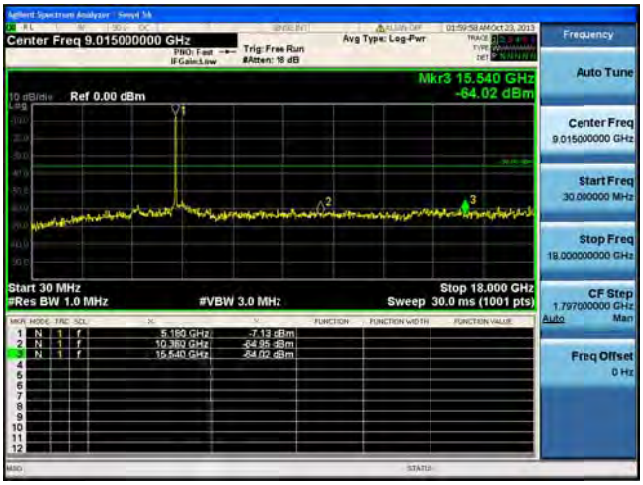



***Antenna B***

***Conducted Spurs Peak, 5180 MHz, HT-20 STBC, M0 to M7***

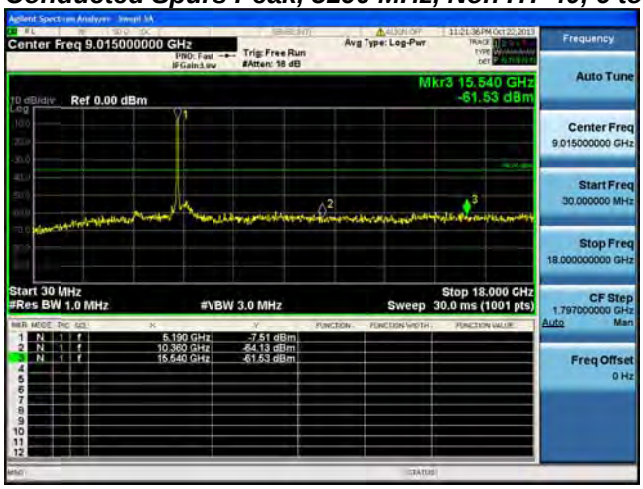



***Antenna A***



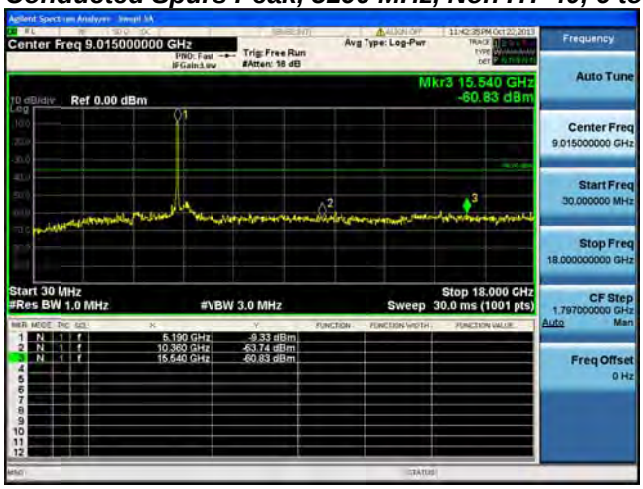

***Antenna B***

***Conducted Spurs Peak, 5190 MHz, Non HT-40, 6 to 54 Mbps***

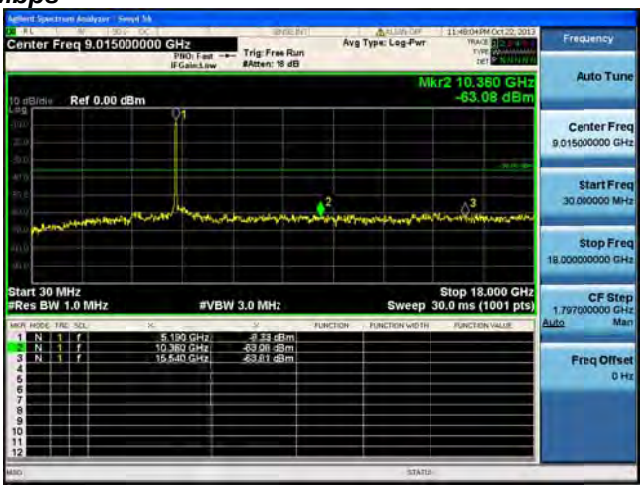



***Antenna A***

***Conducted Spurs Peak, 5190 MHz, Non HT-40, 6 to 54 Mbps***

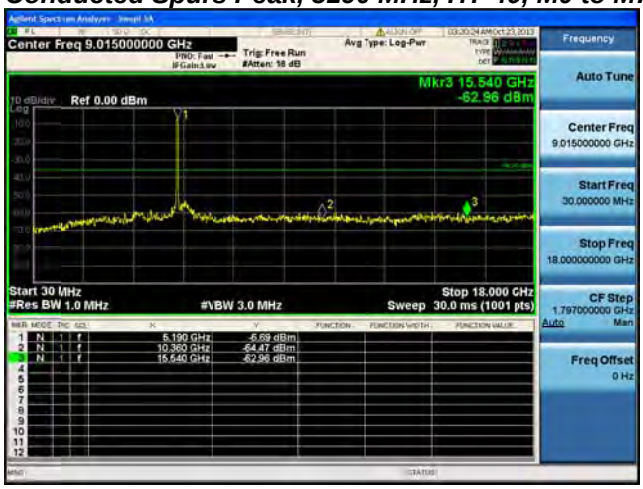



***Antenna A***



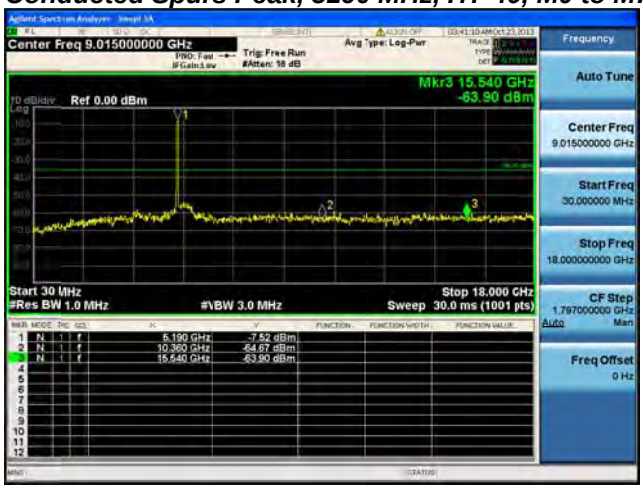

***Antenna B***

***Conducted Spurs Peak, 5190 MHz, HT-40, M0 to M7***

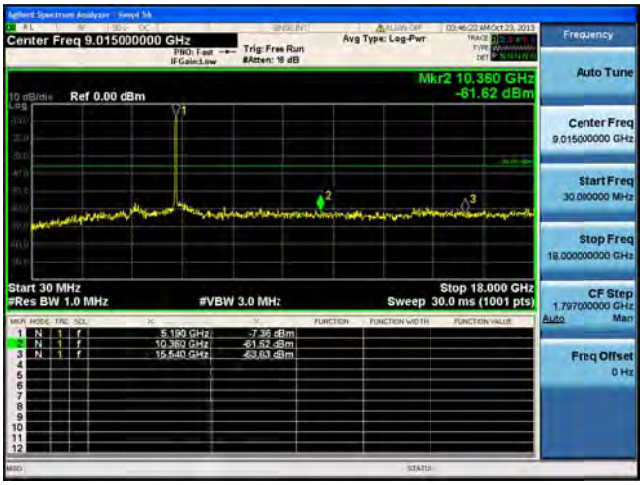



***Antenna A***

***Conducted Spurs Peak, 5190 MHz, HT-40, M0 to M7***

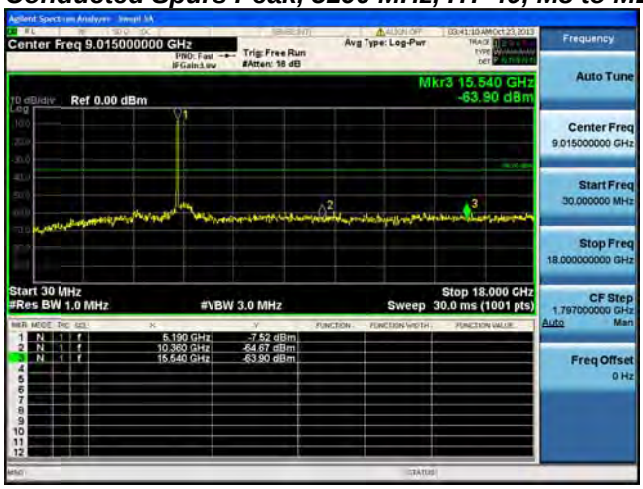



***Antenna A***

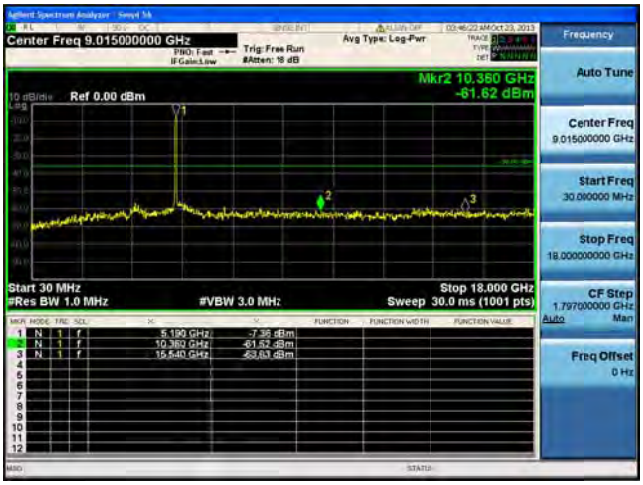



***Antenna B***

***Conducted Spurs Peak, 5190 MHz, HT-40, M8 to M15***

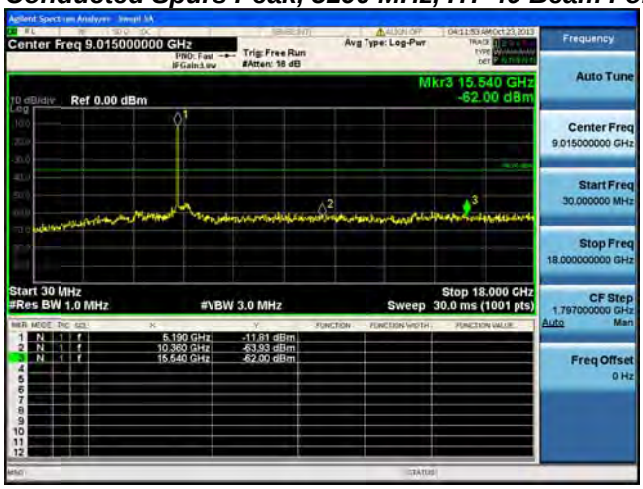



***Antenna A***

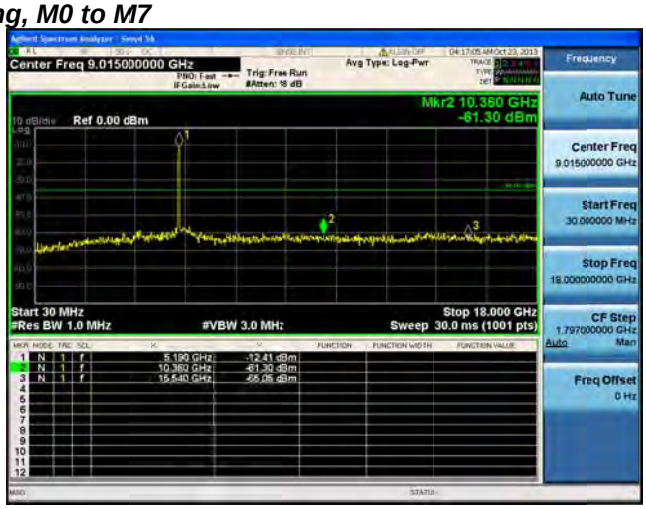



***Antenna B***

***Conducted Spurs Peak, 5190 MHz, HT-40 Beam Forming, M0 to M7***

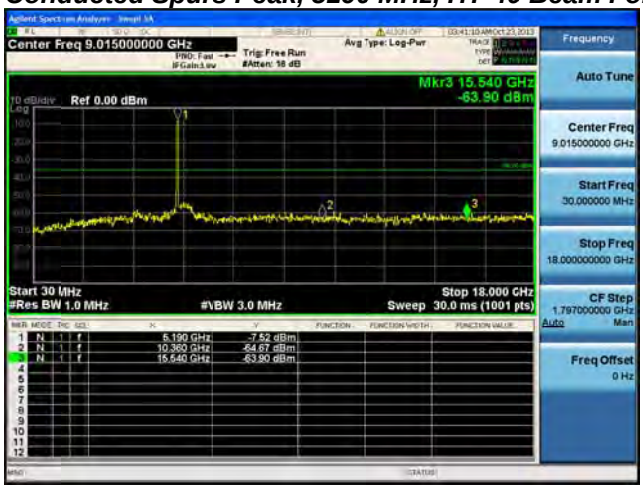



***Antenna A***

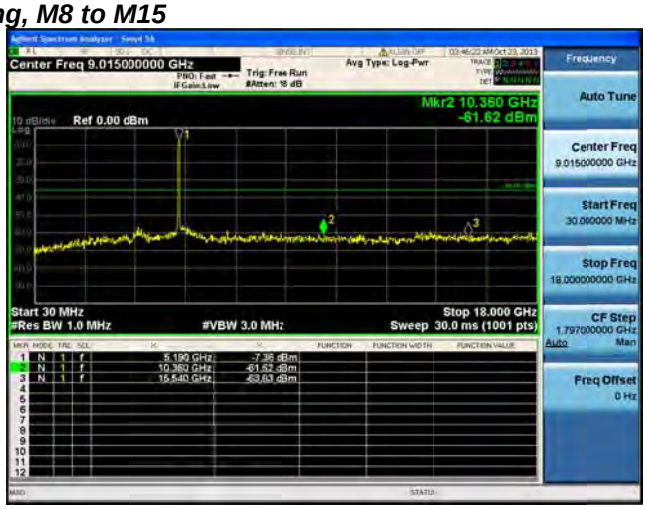



***Antenna B***

***Conducted Spurs Peak, 5190 MHz, HT-40 Beam Forming, M8 to M15***

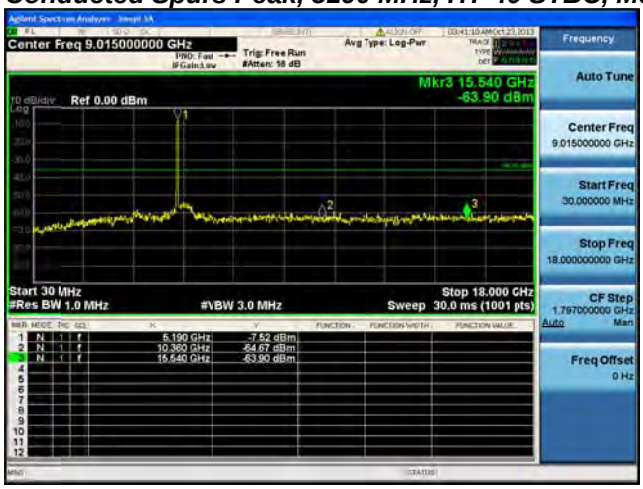



***Antenna A***

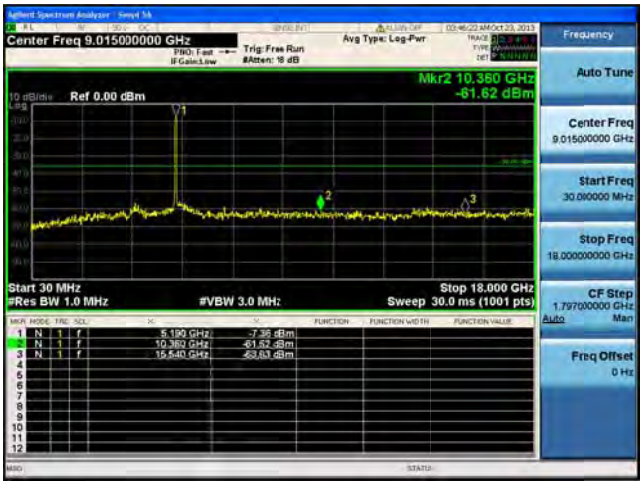



***Antenna B***

***Conducted Spurs Peak, 5190 MHz, HT-40 STBC, M0 to M7***

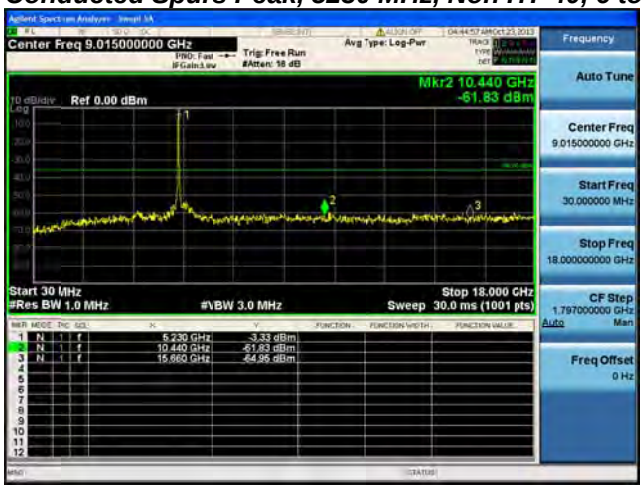



***Antenna A***



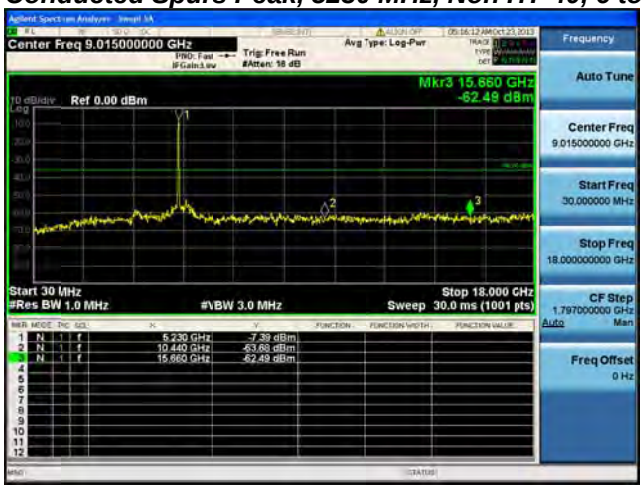

***Antenna B***

***Conducted Spurs Peak, 5230 MHz, Non HT-40, 6 to 54 Mbps***

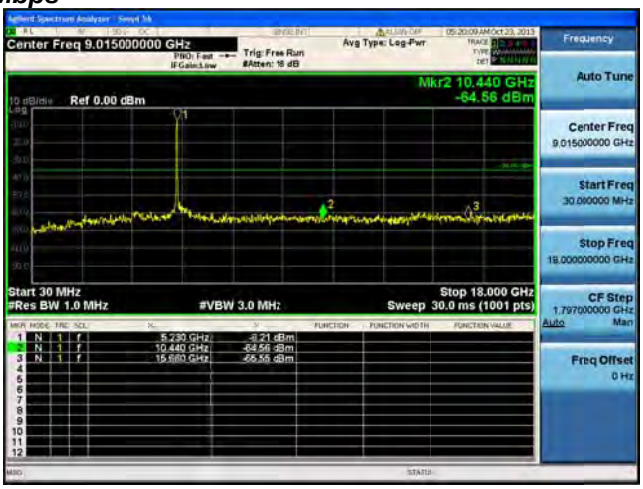



***Antenna A***

***Conducted Spurs Peak, 5230 MHz, Non HT-40, 6 to 54 Mbps***

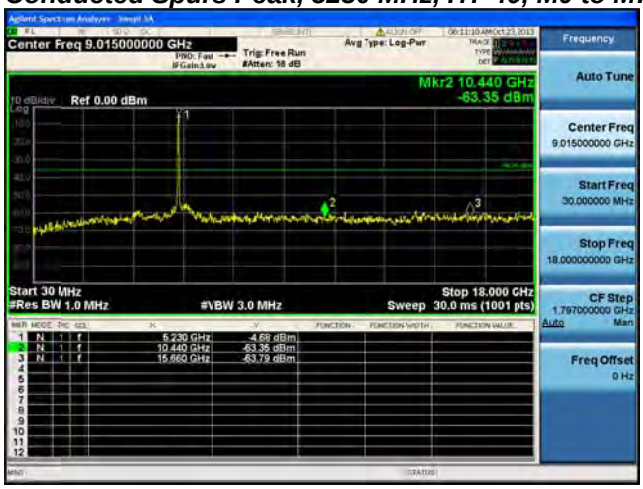



***Antenna A***



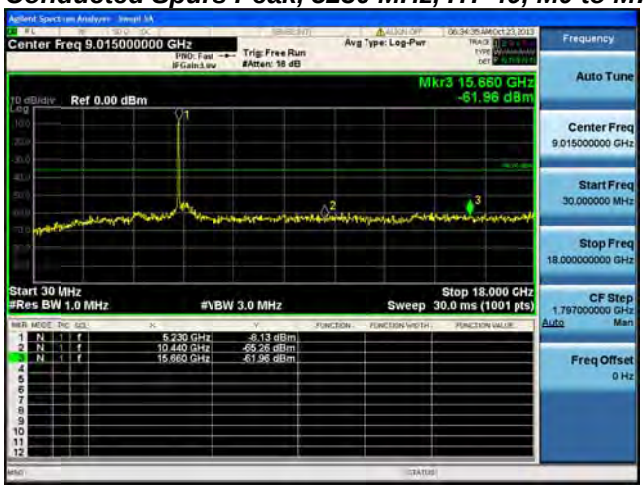

***Antenna B***

***Conducted Spurs Peak, 5230 MHz, HT-40, M0 to M7***

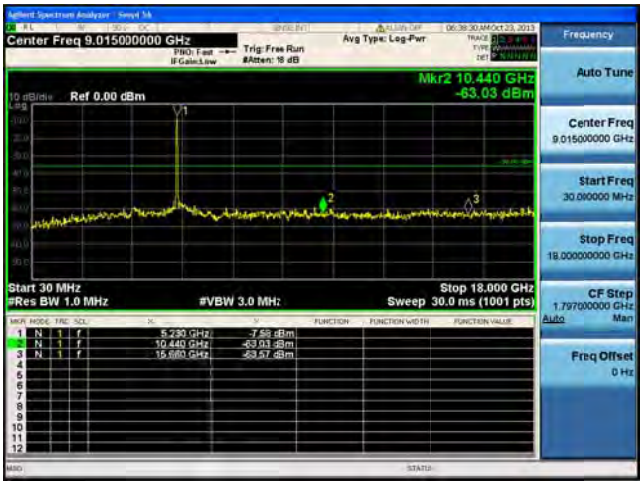



***Antenna A***

***Conducted Spurs Peak, 5230 MHz, HT-40, M0 to M7***

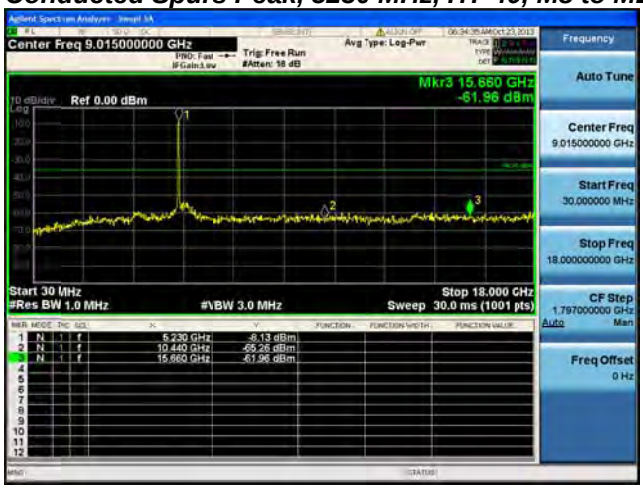



***Antenna A***

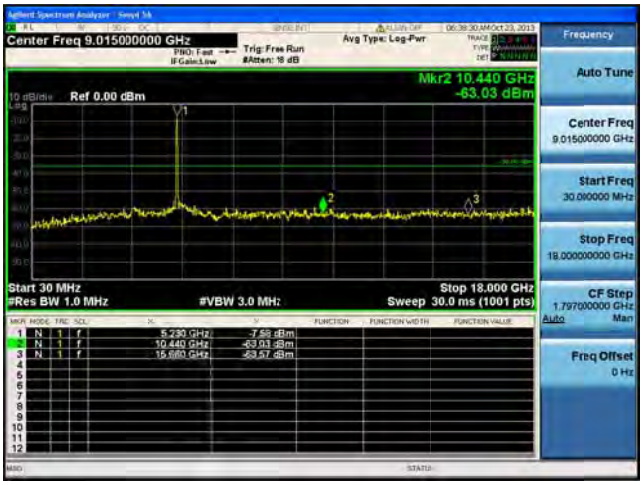



***Antenna B***

***Conducted Spurs Peak, 5230 MHz, HT-40, M8 to M15***

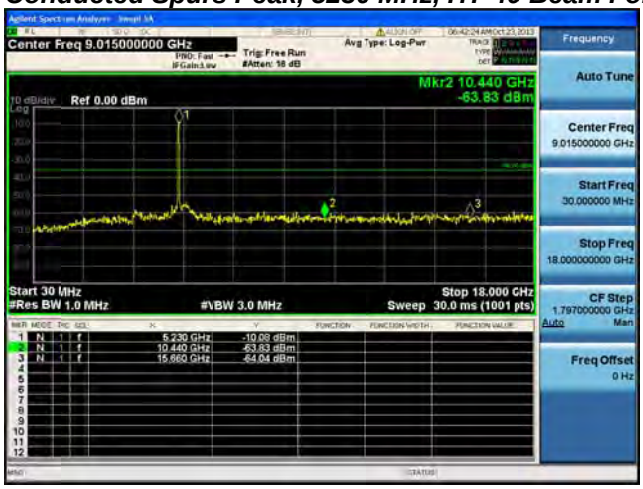



***Antenna A***

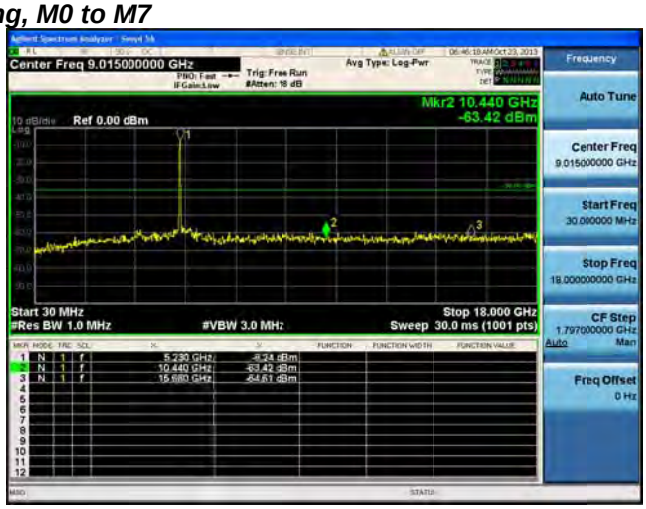



***Antenna B***

***Conducted Spurs Peak, 5230 MHz, HT-40 Beam Forming, M0 to M7***

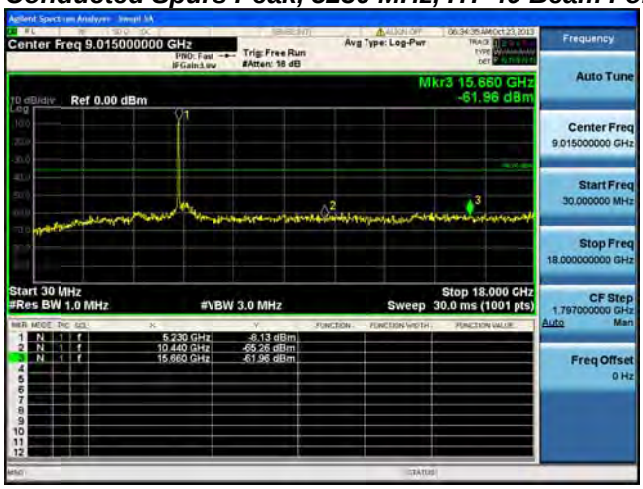



***Antenna A***

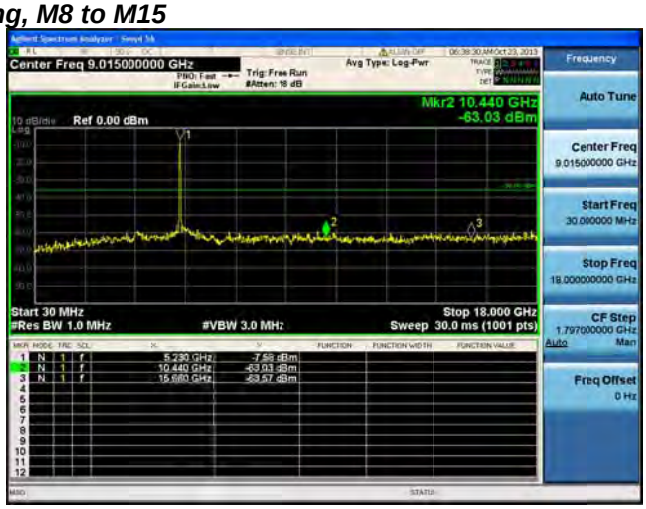



***Antenna B***

***Conducted Spurs Peak, 5230 MHz, HT-40 Beam Forming, M8 to M15***

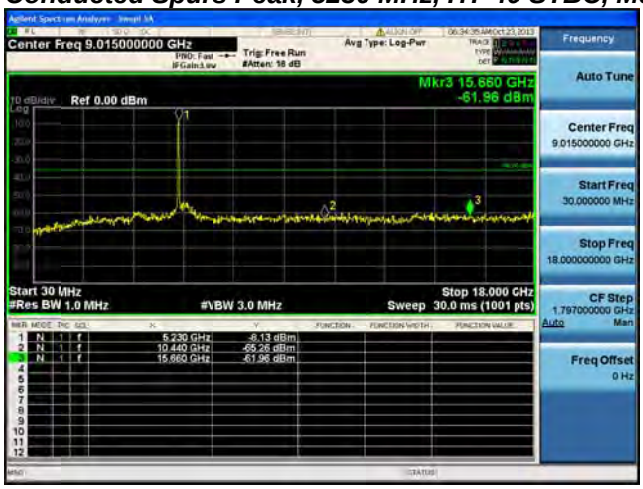



***Antenna A***

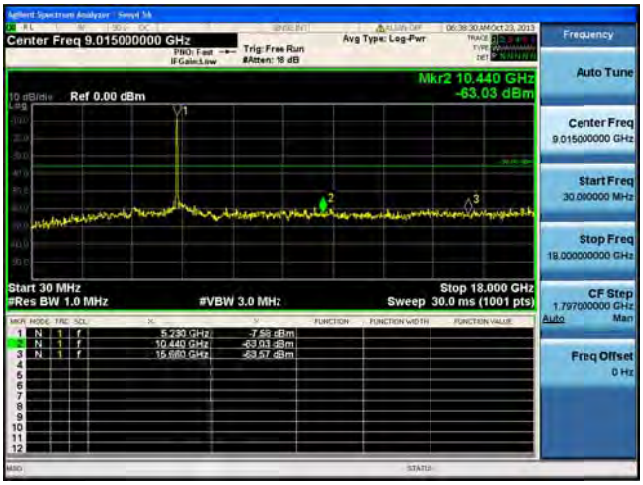



***Antenna B***

***Conducted Spurs Peak, 5230 MHz, HT-40 STBC, M0 to M7***

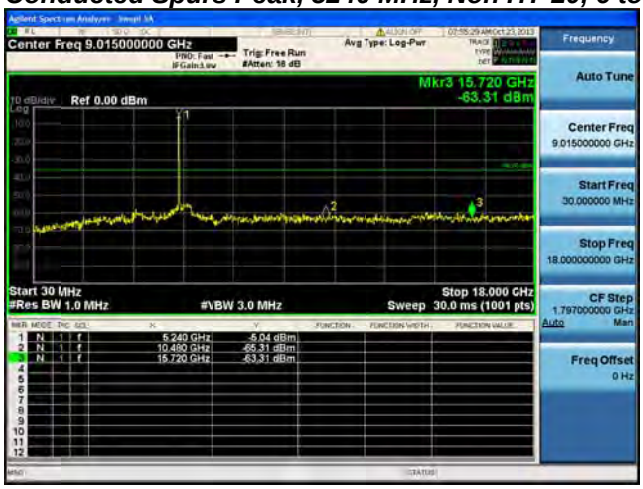



***Antenna A***



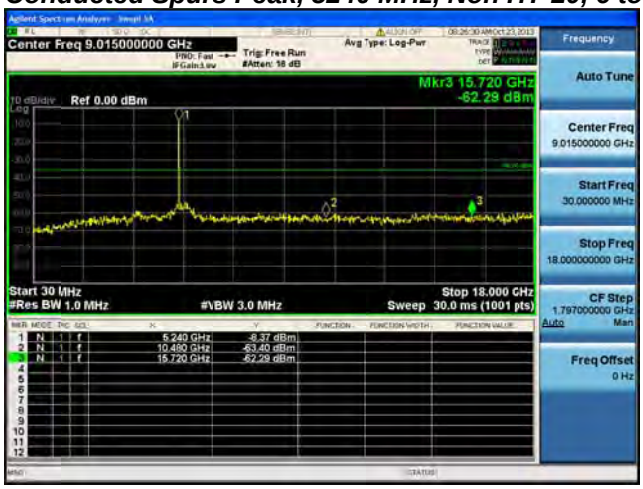

***Antenna B***

***Conducted Spurs Peak, 5240 MHz, Non HT-20, 6 to 54 Mbps***

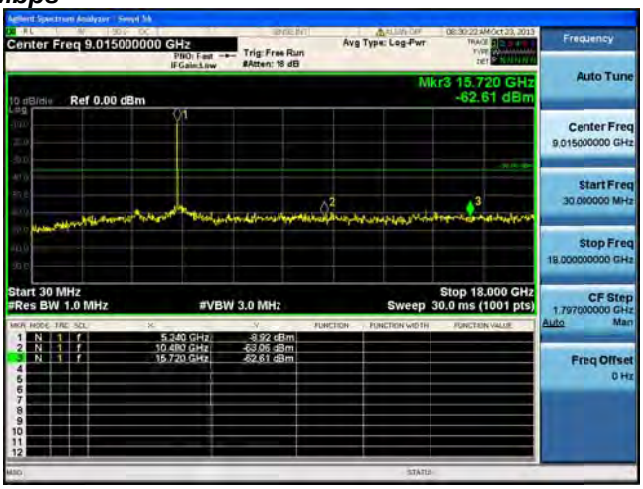



***Antenna A***

***Conducted Spurs Peak, 5240 MHz, Non HT-20, 6 to 54 Mbps***

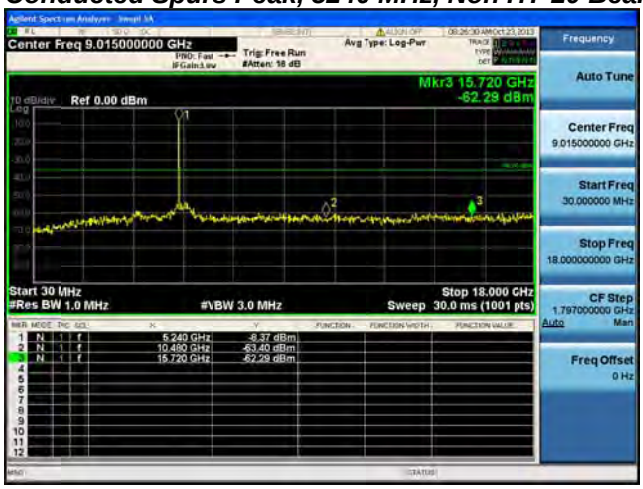



***Antenna A***

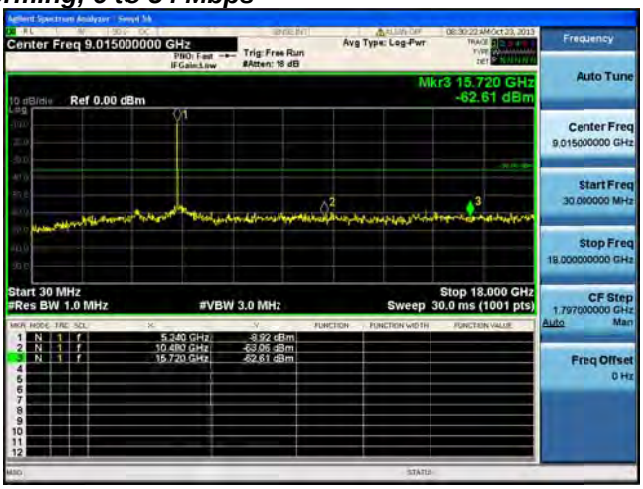



***Antenna B***

***Conducted Spurs Peak, 5240 MHz, Non HT-20 Beam Forming, 6 to 54 Mbps***

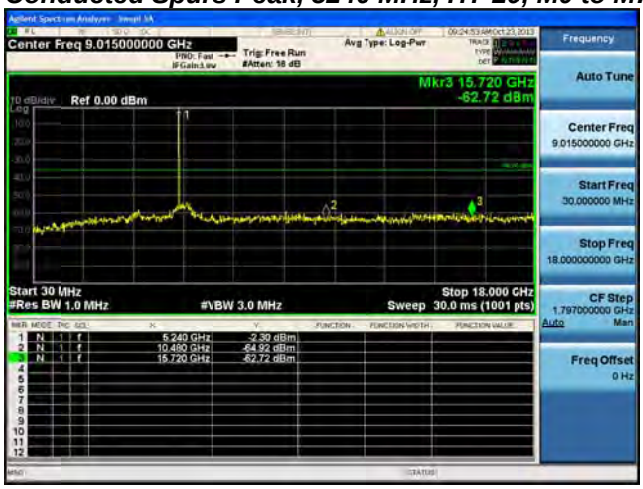



***Antenna A***



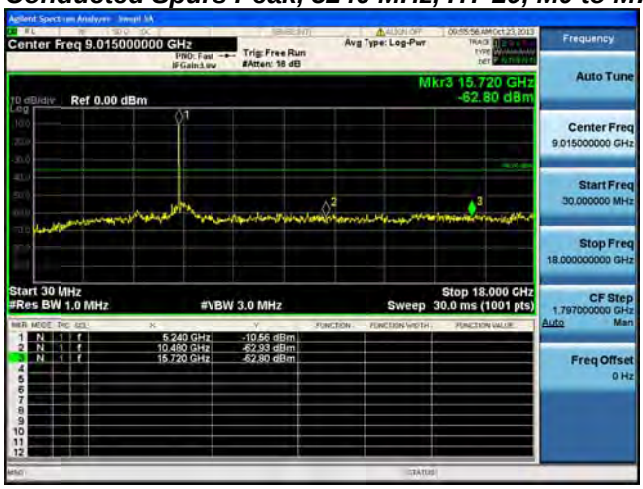

***Antenna B***

***Conducted Spurs Peak, 5240 MHz, HT-20, M0 to M7***

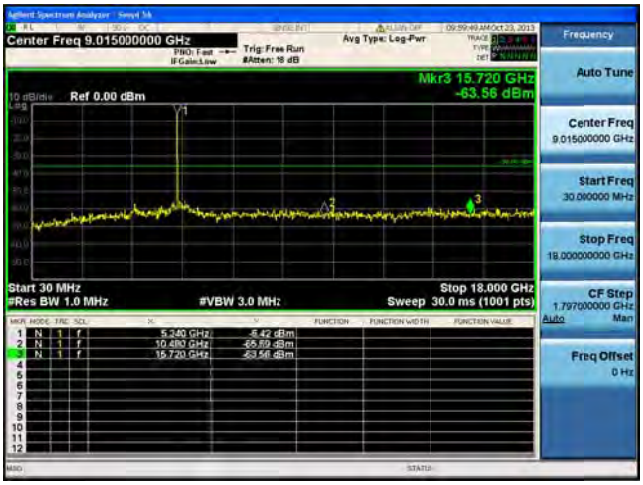



***Antenna A***

***Conducted Spurs Peak, 5240 MHz, HT-20, M0 to M7***

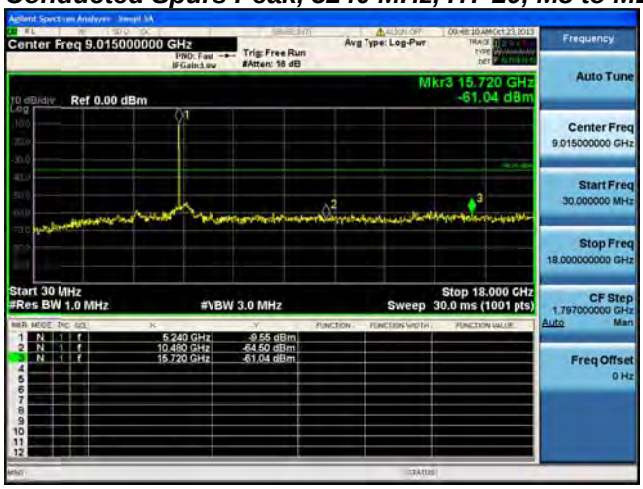



***Antenna A***

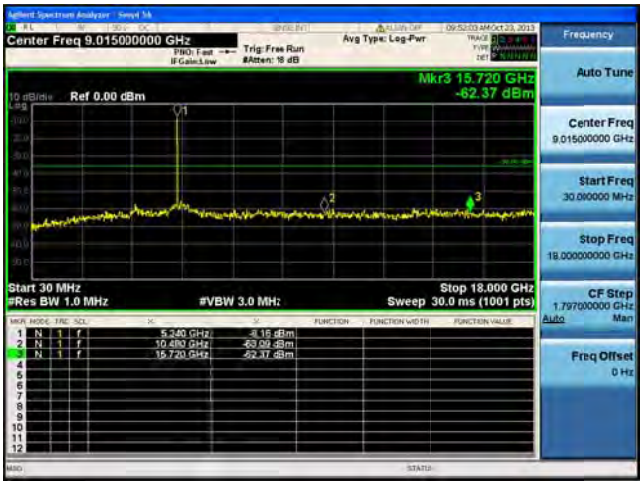



***Antenna B***

***Conducted Spurs Peak, 5240 MHz, HT-20, M8 to M15***

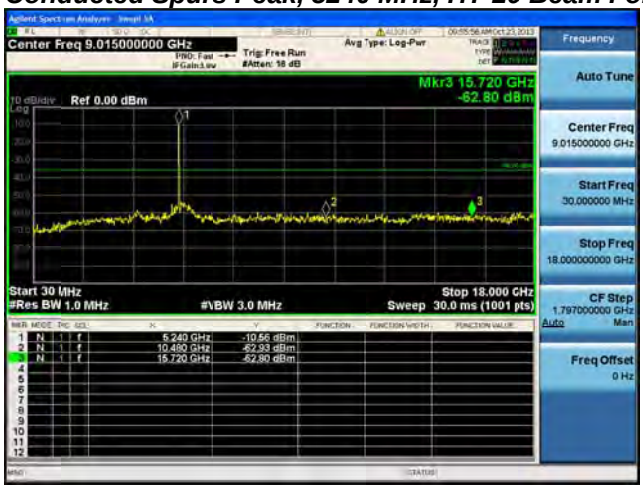



***Antenna A***

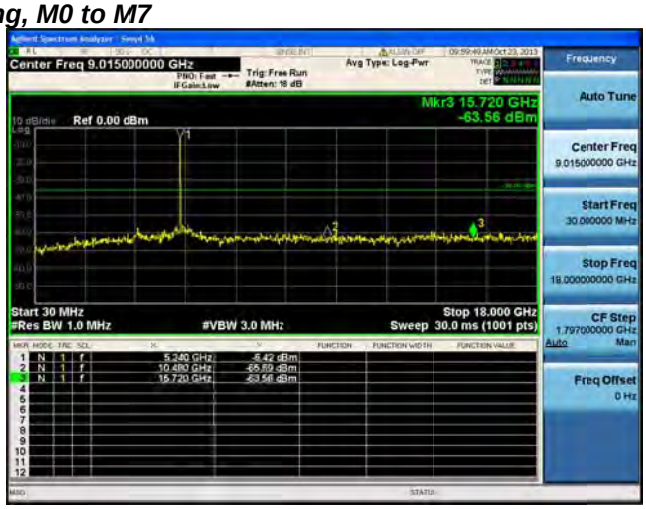



***Antenna B***

***Conducted Spurs Peak, 5240 MHz, HT-20 Beam Forming, M0 to M7***

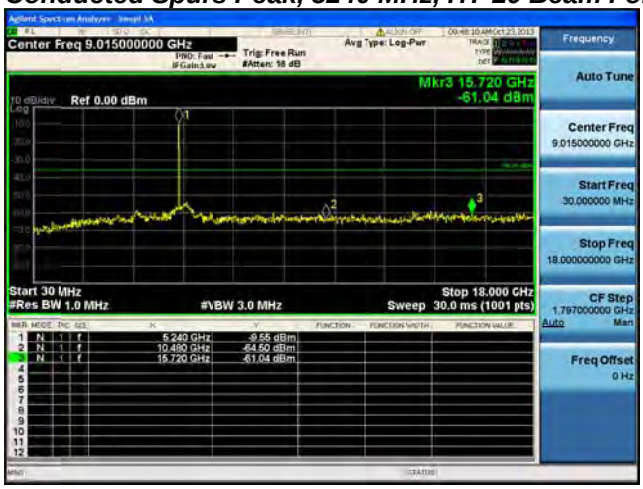



***Antenna A***

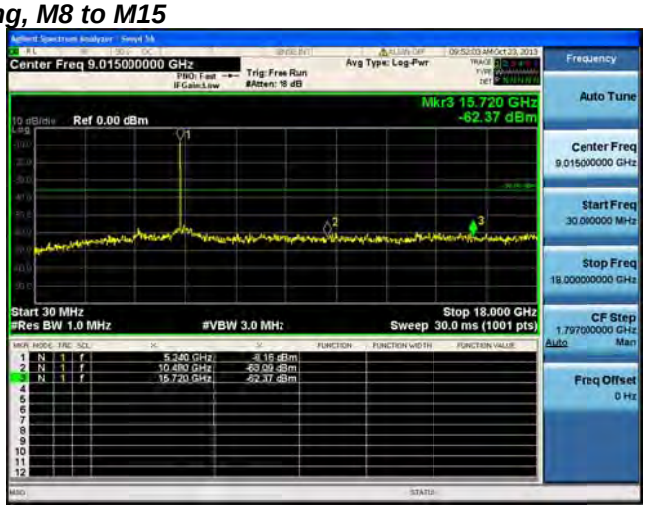



***Antenna B***

***Conducted Spurs Peak, 5240 MHz, HT-20 Beam Forming, M8 to M15***

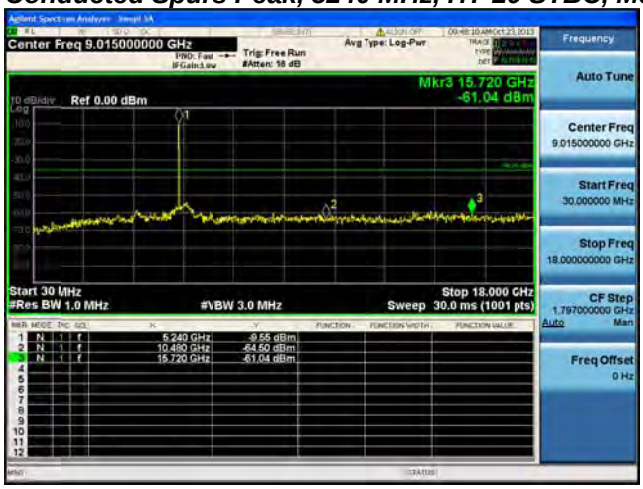



***Antenna A***

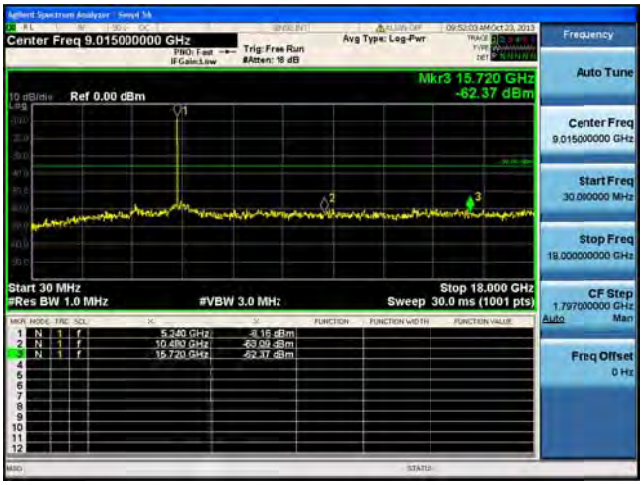



***Antenna B***

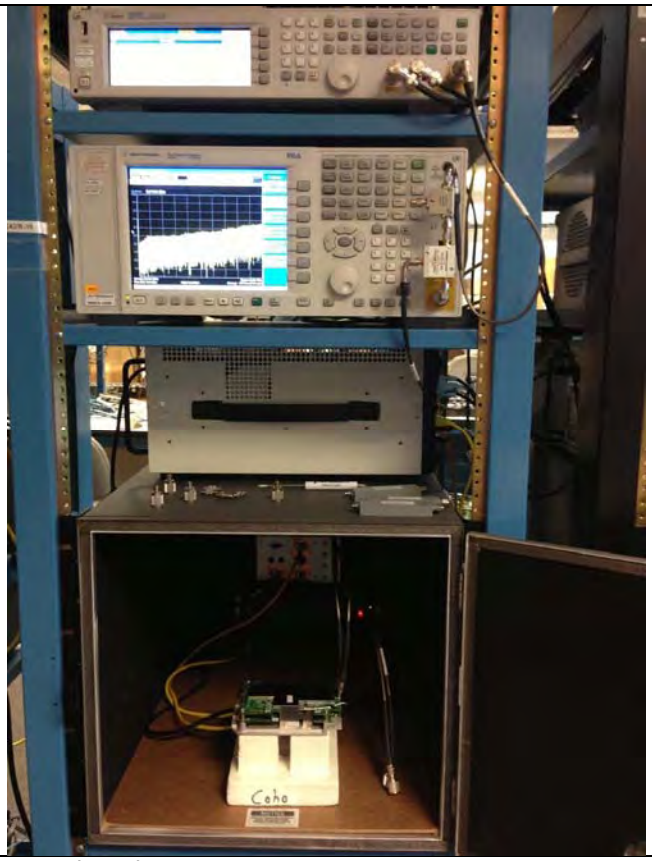
***Conducted Spurs Peak, 5240 MHz, HT-20 STBC, M0 to M7***




***Antenna A***




***Antenna B***



**Title:** Conducted Test Setup

# Conducted Bandedge

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Use the procedures in 718828 D01 DTS Meas Guidance v01 to substitute conducted measurements in place of radiated measurements.
Connect the antenna port(s) to the spectrum analyzer input. Place the radio in continuous transmit mode. Be sure to enter all losses between the transmitter output and the spectrum analyzer.

| | |
|---|---|
| Reference Level: | 10 dBm |
| Attenuation: | 4 dB |
| Sweep Time: | Coupled |
| Resolution Bandwidth: | 1MHz |
| Video Bandwidth: | 1 MHz for peak, 100 Hz for average |
| Detector: | Peak |

Save 2 plots: 1) Average Plot (Vertical and Horizontal), Limit= -41.25 dBm eirp (54dBuV @3m)
2) Peak plot (Vertical and Horizontal), Limit = -21.25 dBm eirp (74dBuV @3m)

Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands.

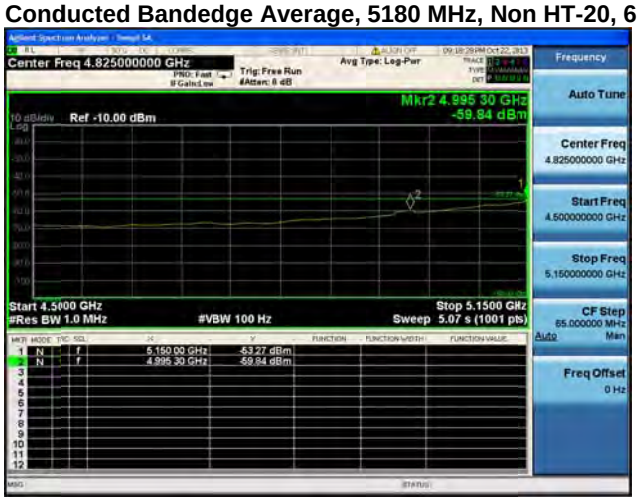
The “measure-and-sum technique” is used for measuring in-band transmit power of a device. In the measure-and-sum approach, the conducted emission level is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in linear power units.

This report represents the worst case data for all supported operating modes and antennas.

| Frequency (MHz) | Mode | Tx Paths | Correlated Antenna Gain (dBi) | Tx 1 Bandedge Level (dBm) | Tx 2 Bandedge Level (dBm) | Total Tx Bandedge Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 5180 | Non HT-20, 6 to 54 Mbps | 1 | 4 | -53.3 | | -49.3 | -41.25 | 8.1 |
| | Non HT-20, 6 to 54 Mbps | 2 | 4 | -55.1 | -50.8 | -45.4 | -41.25 | 4.2 |
| | Non HT-20 Beam Forming, 6 to 54 Mbps | 2 | 7 | -55.1 | -50.8 | -42.4 | -41.25 | 1.2 |
| | HT-20, M0 to M7 | 1 | 4 | -54.1 | | -50.1 | -41.25 | 8.9 |
| | HT-20, M0 to M7 | 2 | 4 | -55.0 | -50.8 | -45.4 | -41.25 | 4.2 |
| | HT-20, M8 to M15 | 2 | 4 | -54.8 | -50.8 | -45.3 | -41.25 | 4.1 |
| | HT-20 Beam Forming, M0 to M7 | 2 | 7 | -55.0 | -50.8 | -42.4 | -41.25 | 1.2 |
| | HT-20 Beam Forming, M8 to M15 | 2 | 4 | -54.8 | -50.8 | -45.3 | -41.25 | 4.1 |
| | HT-20 STBC, M0 to M7 | 2 | 4 | -54.8 | -50.8 | -45.3 | -41.25 | 4.1 |
| | | | | | | | | |
| 5190 | Non HT-40, 6 to 54 Mbps | 1 | 4 | -46.6 | | -42.6 | -41.25 | 1.4 |
| | Non HT-40, 6 to 54 Mbps | 2 | 4 | -52.3 | -50.6 | -4.44 | -41.25 | 3.1 |
| | HT-40, M0 to M7 | 1 | 4 | -47.2 | | -43.2 | -41.25 | 2.0 |
| | HT-40, M0 to M7 | 2 | 4 | -48.7 | -50.2 | -42.4 | -41.25 | 1.1 |
| | HT-40, M8 to M15 | 2 | 4 | -48.7 | -50.2 | -42.4 | -41.25 | 1.1 |
| | HT-40 Beam Forming, M0 to M7 | 2 | 7 | -52.8 | -50.8 | -41.7 | -41.25 | 0.4 |
| | HT-40 Beam Forming, M8 to M15 | 2 | 4 | -48.7 | -50.2 | -42.4 | -41.25 | 1.1 |
| | HT-40 STBC, M0 to M7 | 2 | 4 | -48.7 | -50.2 | -42.4 | -41.25 | 1.1 |

| Frequency (MHz) | Mode | Tx Paths | Correlated Antenna Gain (dBi) | Tx 1 Bandedge Level (dBm) | Tx 2 Bandedge Level (dBm) | Total Tx Bandedge Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 5180 | Non HT-20, 6 to 54 Mbps | 1 | 4 | -42.1 | | -38.1 | -21.25 | 16.9 |
| | Non HT-20, 6 to 54 Mbps | 2 | 4 | -42.8 | -44.8 | -36.7 | -21.25 | 15.4 |
| | Non HT-20 Beam Forming, 6 to 54 Mbps | 2 | 7 | -42.8 | -44.8 | -33.7 | -21.25 | 12.4 |
| | HT-20, M0 to M7 | 1 | 4 | -41.5 | | -37.5 | -21.25 | 16.3 |
| | HT-20, M0 to M7 | 2 | 4 | -42.2 | -44.7 | -36.3 | -21.25 | 15.0 |
| | HT-20, M8 to M15 | 2 | 4 | -40.8 | -43.1 | -34.8 | -21.25 | 13.5 |
| | HT-20 Beam Forming, M0 to M7 | 2 | 7 | -42.2 | -44.7 | -33.3 | -21.25 | 12.0 |
| | HT-20 Beam Forming, M8 to M15 | 2 | 4 | -40.8 | -43.1 | -34.8 | -21.25 | 13.5 |
| | HT-20 STBC, M0 to M7 | 2 | 4 | -40.8 | -43.1 | -34.8 | -21.25 | 13.5 |
| | | | | | | | | |
| 5190 | Non HT-40, 6 to 54 Mbps | 1 | 4 | -38.5 | | -34.5 | -21.25 | 13.3 |
| | Non HT-40, 6 to 54 Mbps | 2 | 4 | -40.9 | -42.1 | -34.4 | -21.25 | 13.2 |
| | HT-40, M0 to M7 | 1 | 4 | -36.9 | | -32.9 | -21.25 | 11.7 |
| | HT-40, M0 to M7 | 2 | 4 | -41.1 | -41.0 | -34.0 | -21.25 | 12.8 |
| | HT-40, M8 to M15 | 2 | 4 | -41.1 | -41.0 | -34.0 | -21.25 | 12.8 |
| | HT-40 Beam Forming, M0 to M7 | 2 | 7 | -41.5 | -44.6 | -32.8 | -21.25 | 11.5 |
| | HT-40 Beam Forming, M8 to M15 | 2 | 4 | -41.1 | -41.0 | -34.0 | -21.25 | 12.8 |
| | HT-40 STBC, M0 to M7 | 2 | 4 | -41.1 | -41.0 | -34.0 | -21.25 | 12.8 |

**Conducted Bandedge Average, 5180 MHz, Non HT-20, 6 to 54 Mbps**



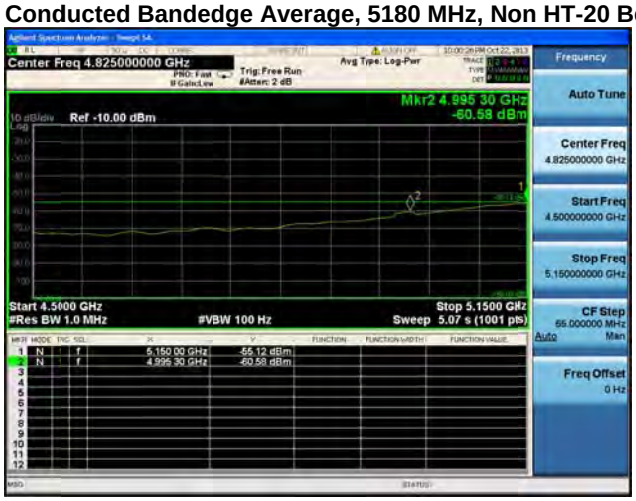

***Antenna A***

***Conducted Bandedge Average, 5180 MHz, Non HT-20, 6 to 54 Mbps***

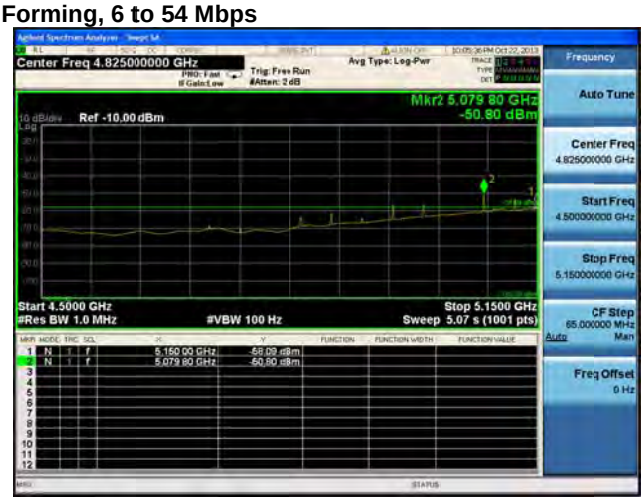

***Antenna A***


***Antenna B***

**Conducted Bandedge Average, 5180 MHz, Non HT-20 Beam Forming, 6 to 54 Mbps**

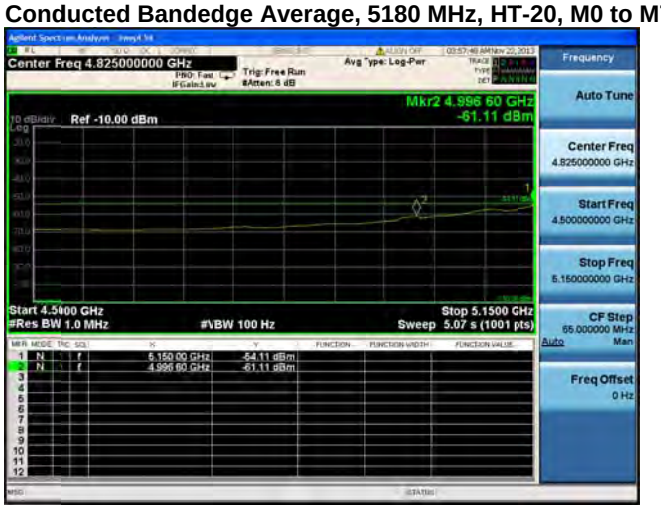



***Antenna A***



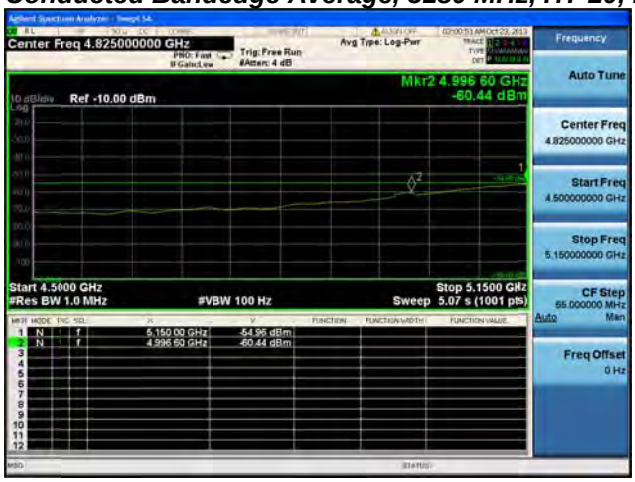

***Antenna B***

**Conducted Bandedge Average, 5180 MHz, HT-20, M0 to M7**




***Antenna A***

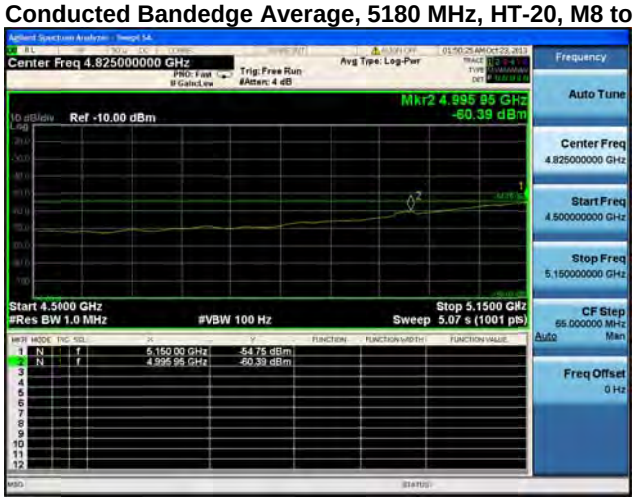
***Conducted Bandedge Average, 5180 MHz, HT-20, M0 to M7***




***Antenna A***


***Antenna B***

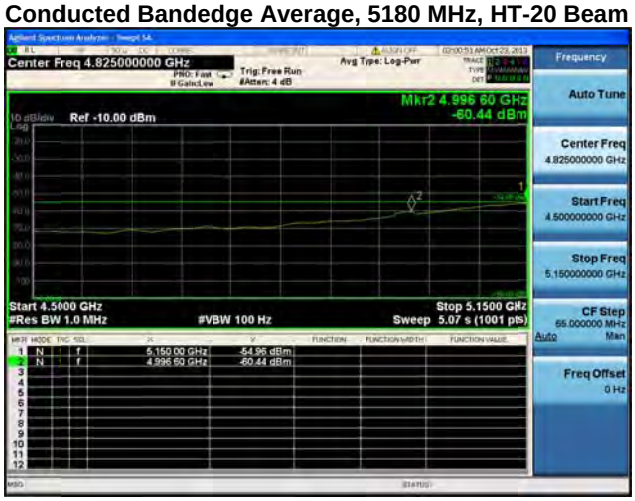
**Conducted Bandedge Average, 5180 MHz, HT-20, M8 to M15**



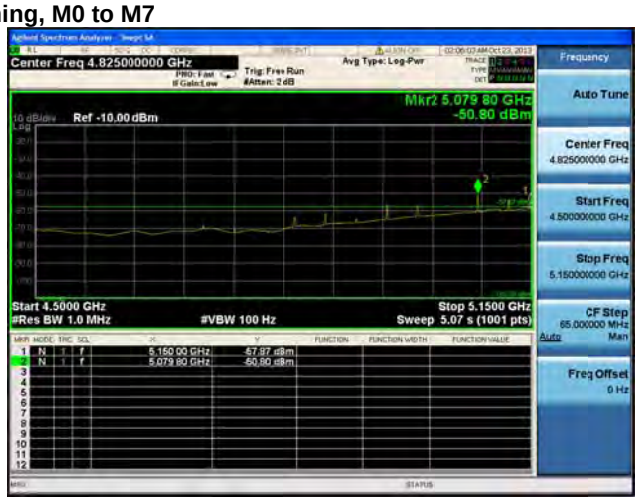

***Antenna A***


***Antenna B***

**Conducted Bandedge Average, 5180 MHz, HT-20 Beam Forming, M0 to M7**

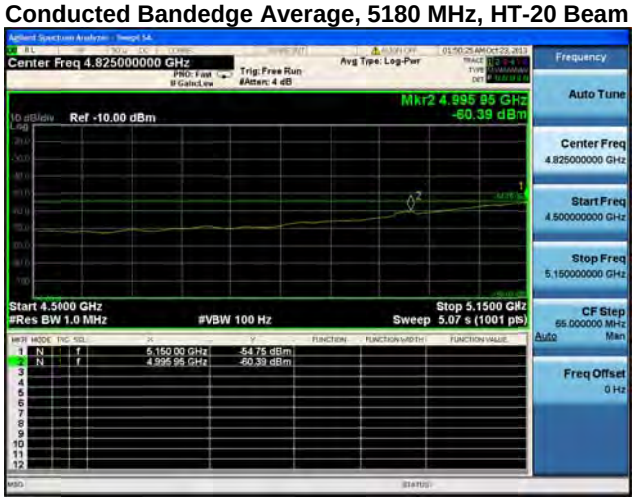



***Antenna A***

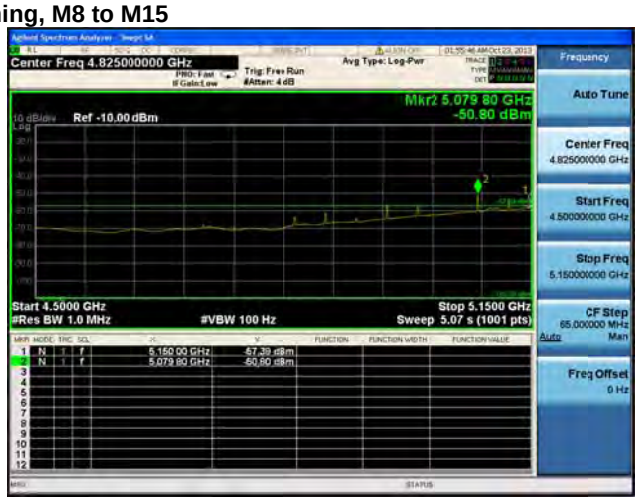



***Antenna B***

**Conducted Bandedge Average, 5180 MHz, HT-20 Beam Forming, M8 to M15**

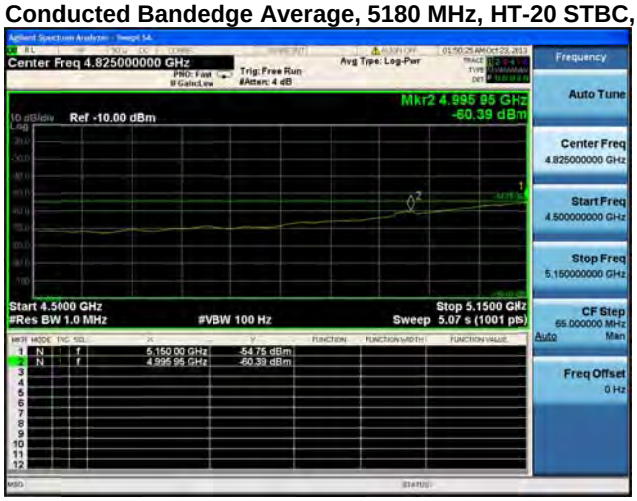



***Antenna A***




***Antenna B***

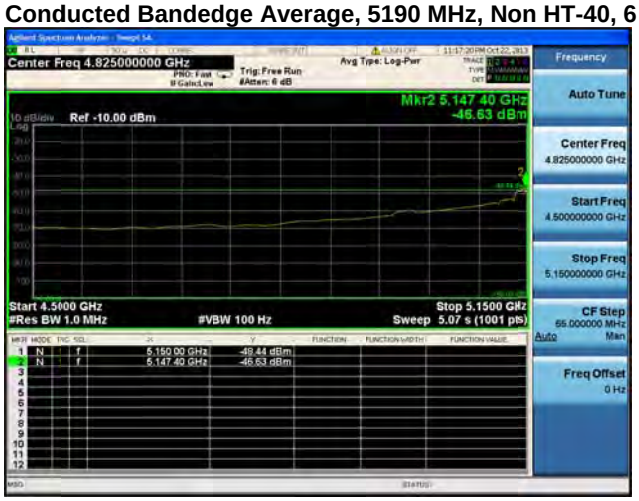
**Conducted Bandedge Average, 5180 MHz, HT-20 STBC, M0 to M7**




***Antenna A***

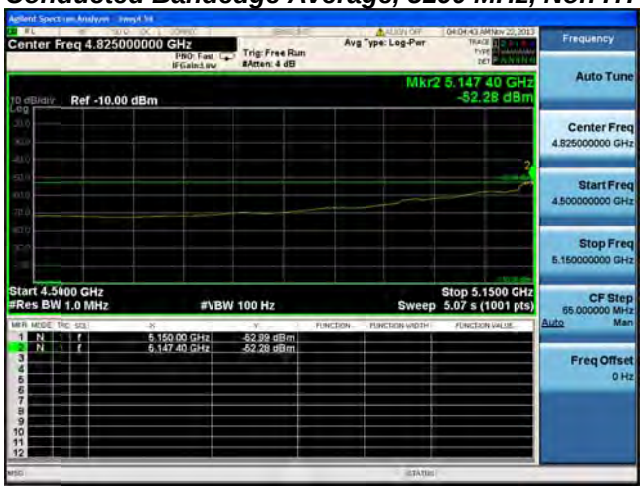

***Antenna B***

**Conducted Bandedge Average, 5190 MHz, Non HT-40, 6 to 54 Mbps**




***Antenna A***

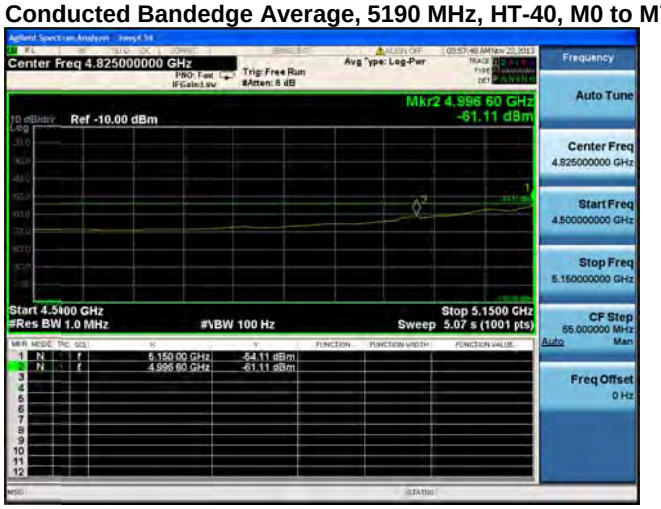
***Conducted Bandedge Average, 5190 MHz, Non HT-40, 6 to 54 Mbps***




***Antenna A***

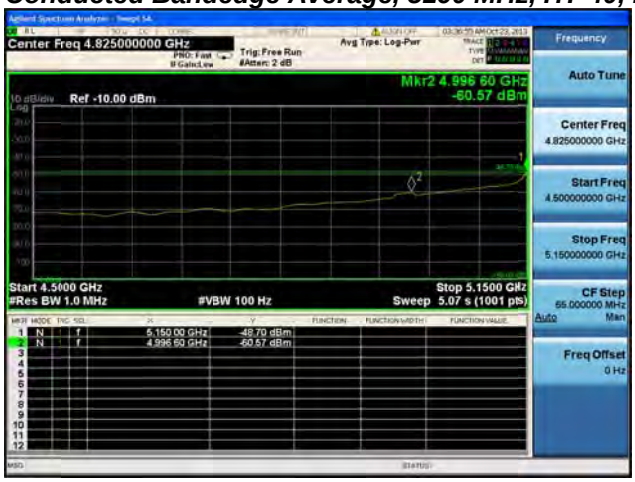

***Antenna B***

**Conducted Bandedge Average, 5190 MHz, HT-40, M0 to M7**




***Antenna A***

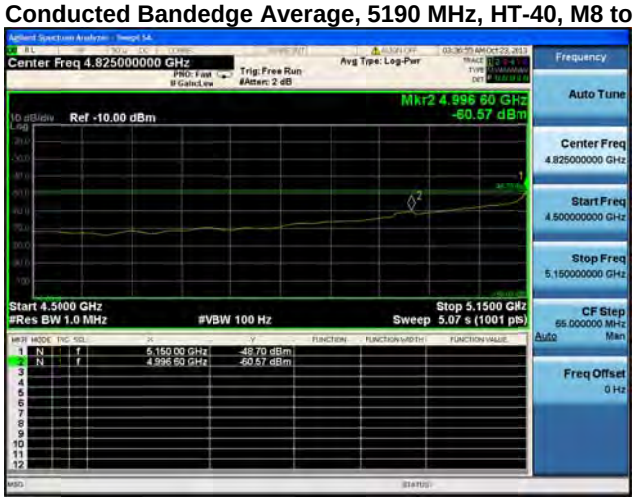
***Conducted Bandedge Average, 5190 MHz, HT-40, M0 to M7***




***Antenna A***


***Antenna B***

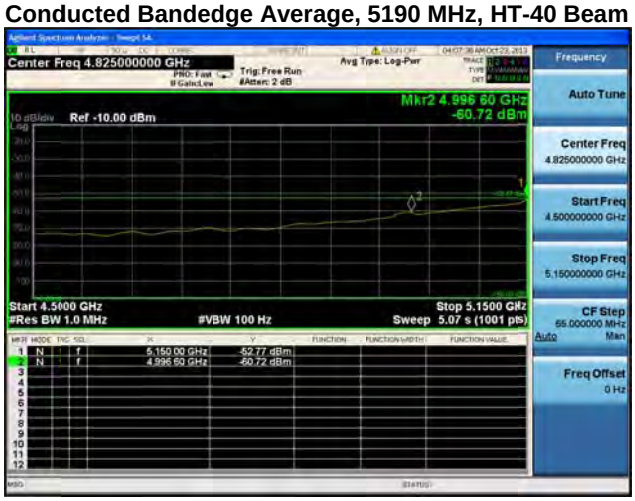
**Conducted Bandedge Average, 5190 MHz, HT-40, M8 to M15**



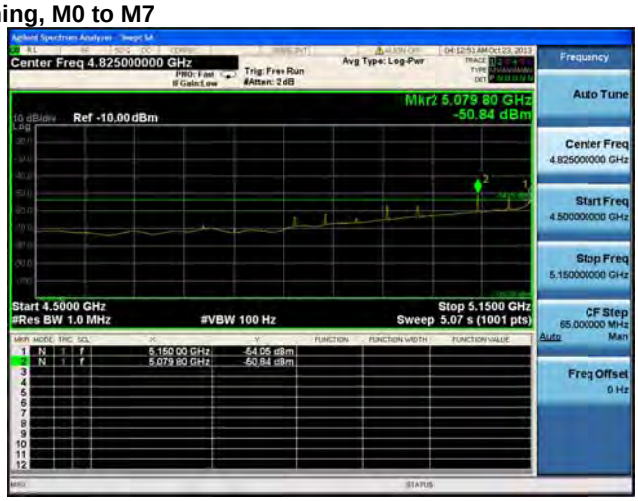

***Antenna A***


***Antenna B***

**Conducted Bandedge Average, 5190 MHz, HT-40 Beam Forming, M0 to M7**

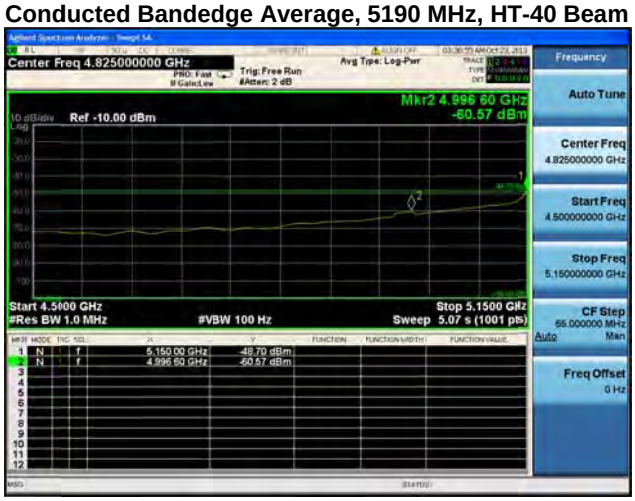



***Antenna A***

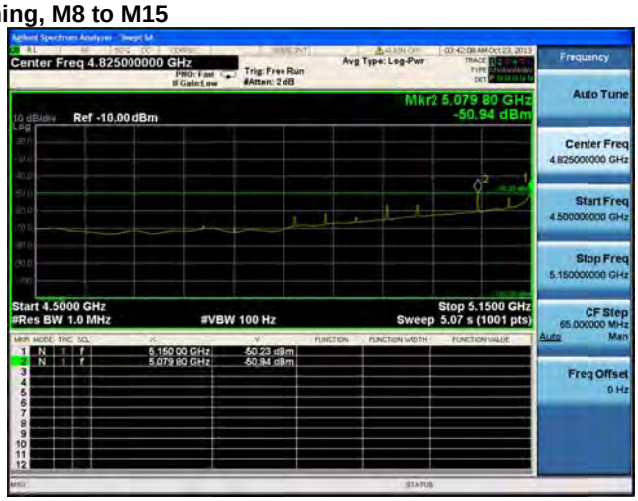



***Antenna B***

**Conducted Bandedge Average, 5190 MHz, HT-40 Beam Forming, M8 to M15**

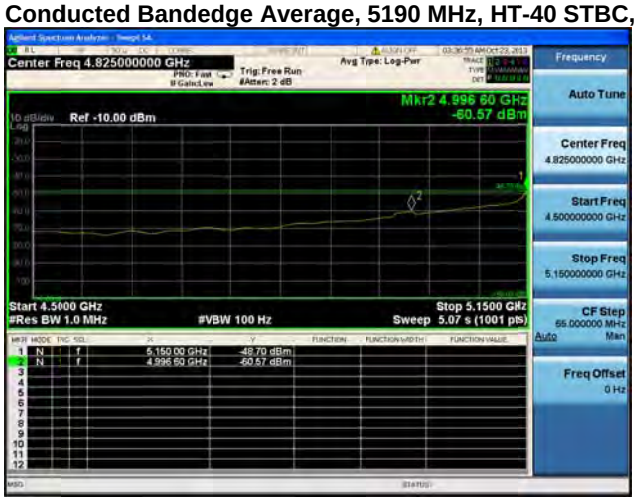



***Antenna A***




***Antenna B***

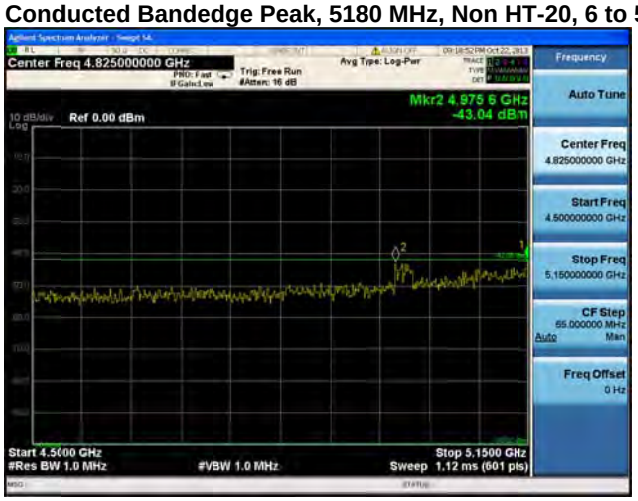
**Conducted Bandedge Average, 5190 MHz, HT-40 STBC, M0 to M7**




***Antenna A***


***Antenna B***

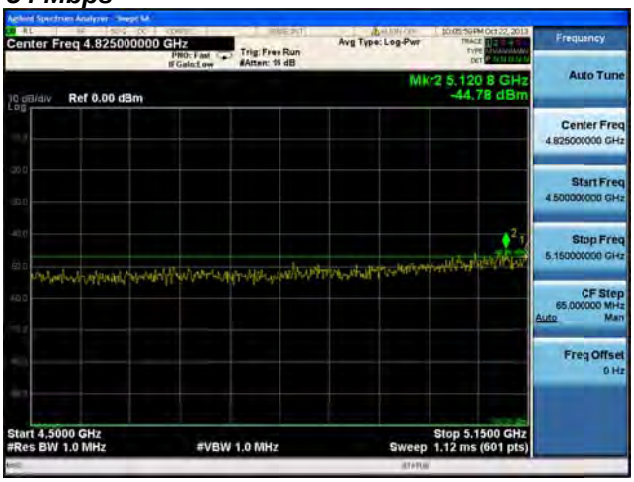
**Conducted Bandedge Peak, 5180 MHz, Non HT-20, 6 to 54 Mbps**




***Antenna A***

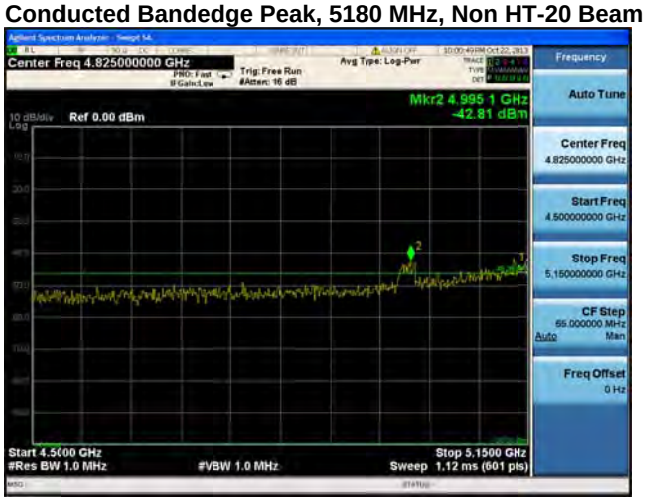
***Conducted Bandedge Peak, 5180 MHz, Non HT-20, 6 to 54 Mbps***


***Antenna A***

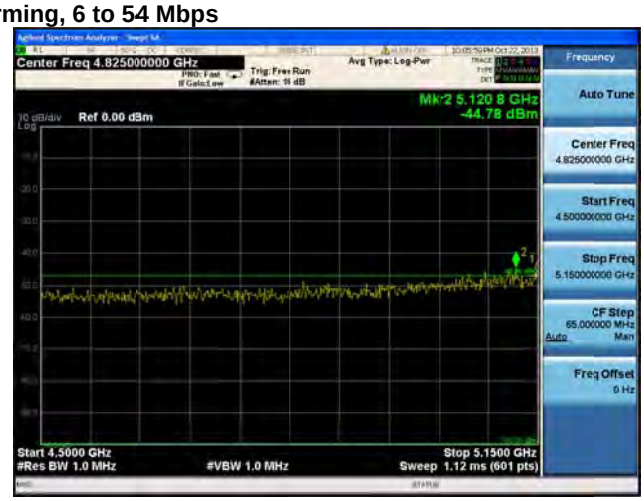



***Antenna B***

**Conducted Bandedge Peak, 5180 MHz, Non HT-20 Beam Forming, 6 to 54 Mbps**

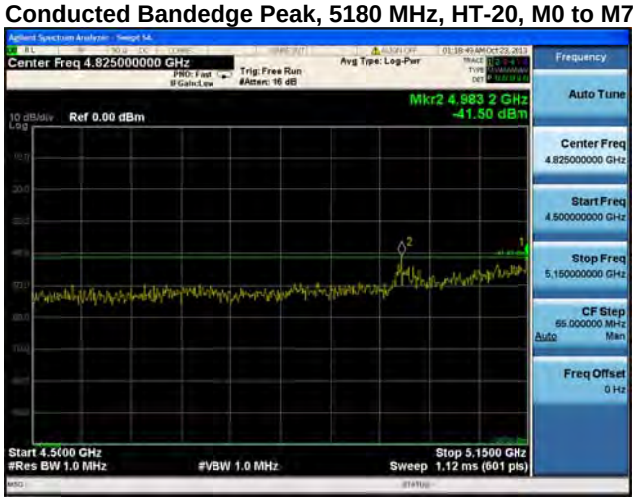



***Antenna A***




***Antenna B***

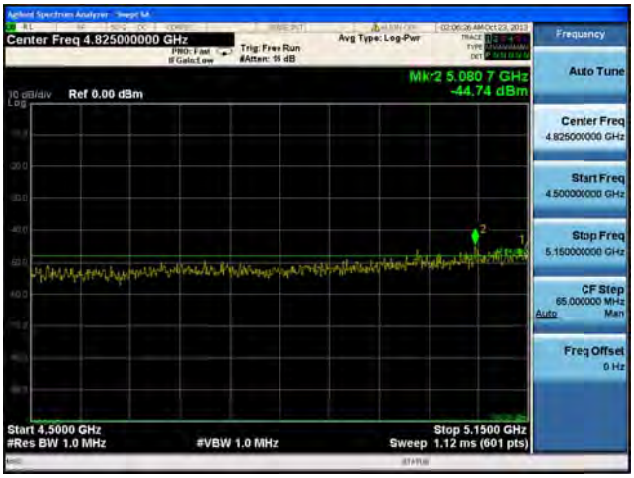
**Conducted Bandedge Peak, 5180 MHz, HT-20, M0 to M7**




***Antenna A***

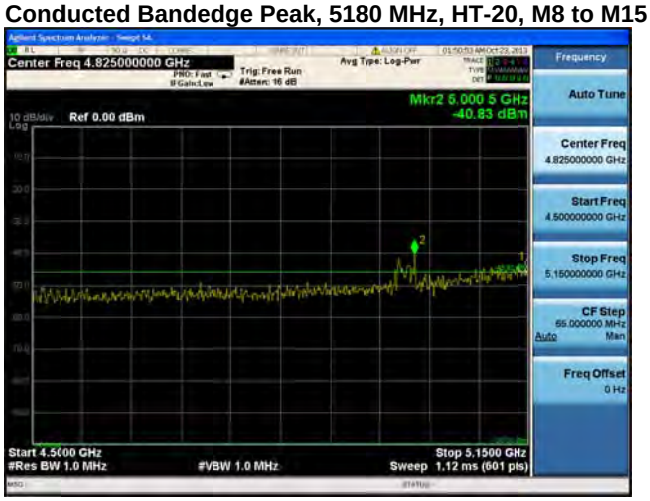
***Conducted Bandedge Peak, 5180 MHz, HT-20, M0 to M7***


***Antenna A***

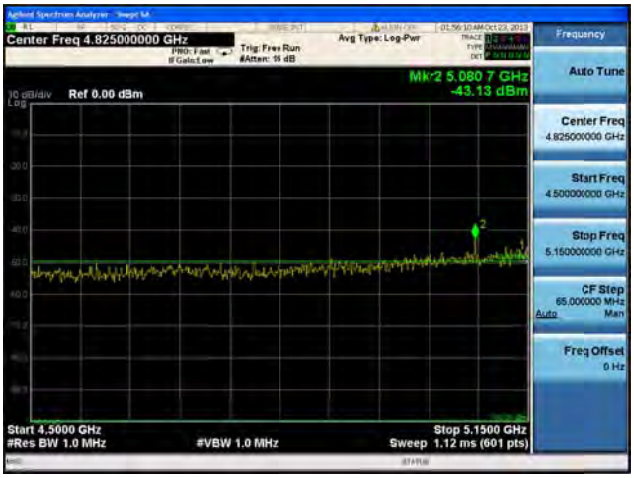



***Antenna B***

**Conducted Bandedge Peak, 5180 MHz, HT-20, M8 to M15**

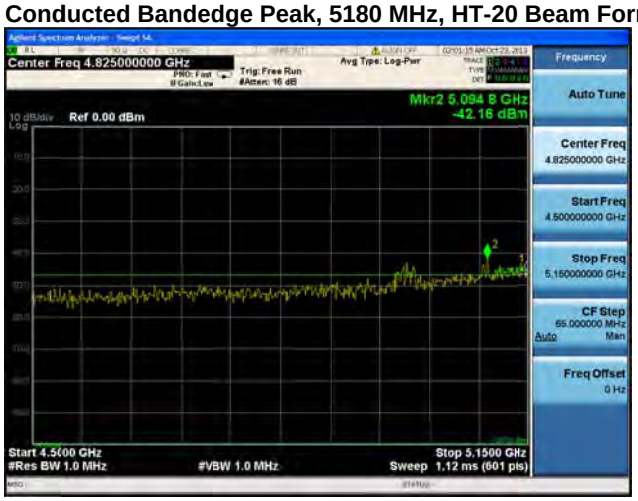



***Antenna A***

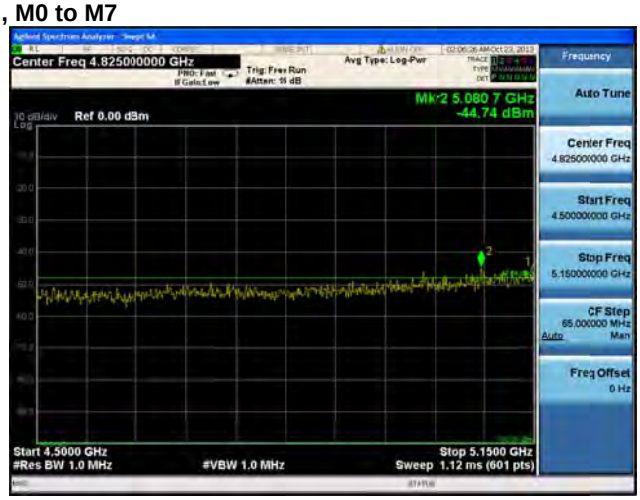



***Antenna B***

**Conducted Bandedge Peak, 5180 MHz, HT-20 Beam Forming, M0 to M7**

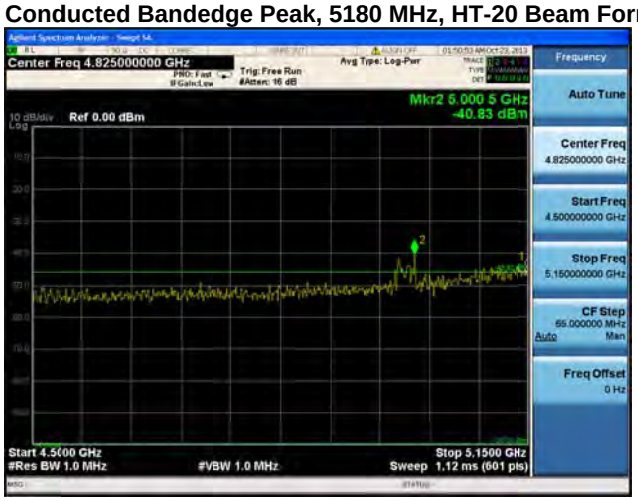



***Antenna A***

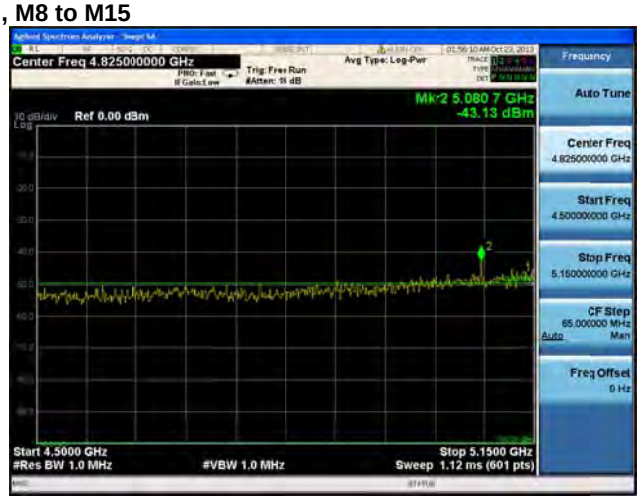



***Antenna B***

**Conducted Bandedge Peak, 5180 MHz, HT-20 Beam Forming, M8 to M15**

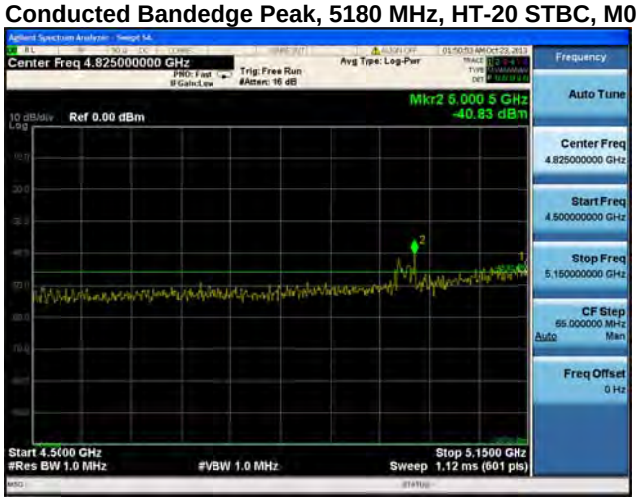



***Antenna A***

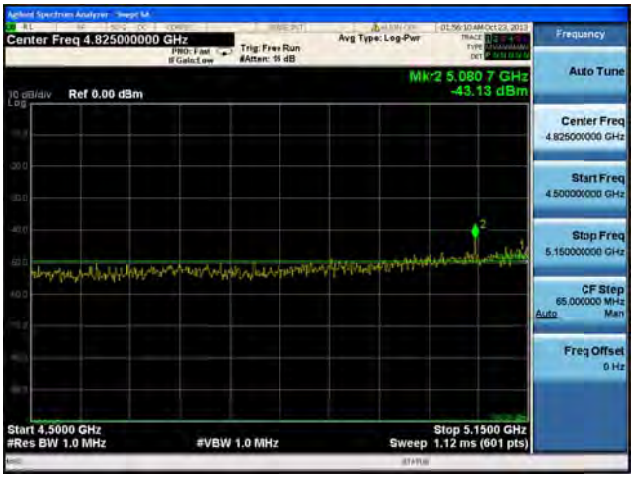



***Antenna B***

**Conducted Bandedge Peak, 5180 MHz, HT-20 STBC, M0 to M7**

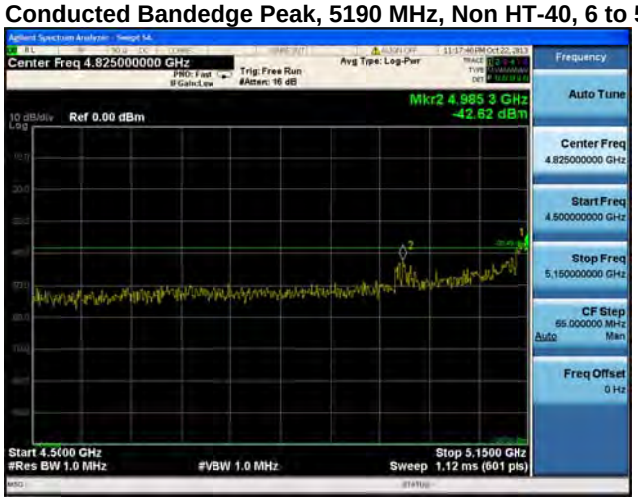



***Antenna A***



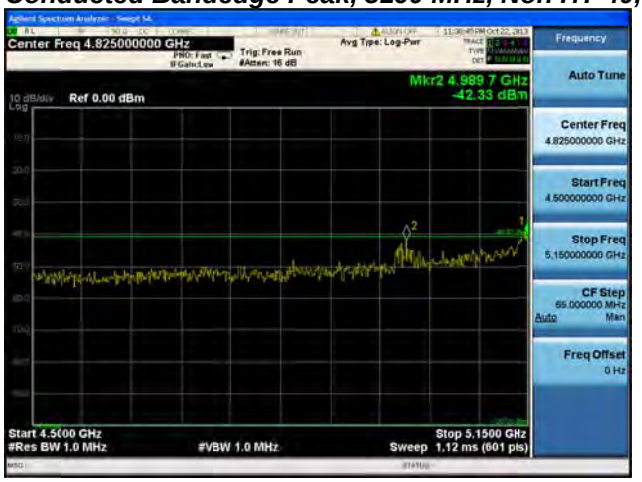

***Antenna B***

**Conducted Bandedge Peak, 5190 MHz, Non HT-40, 6 to 54 Mbps**

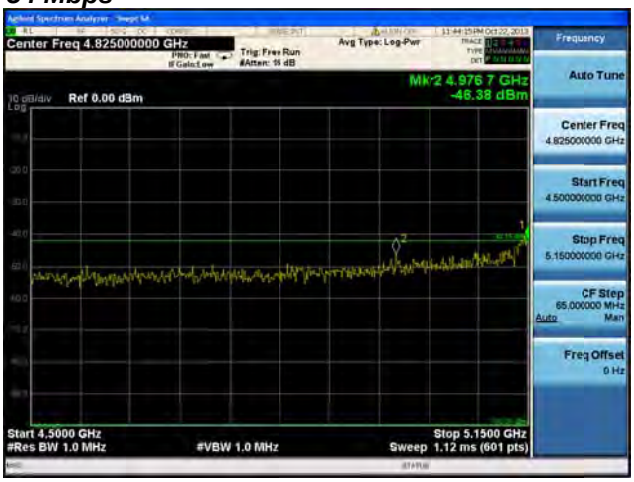



***Antenna A***

***Conducted Bandedge Peak, 5190 MHz, Non HT-40, 6 to 54 Mbps***

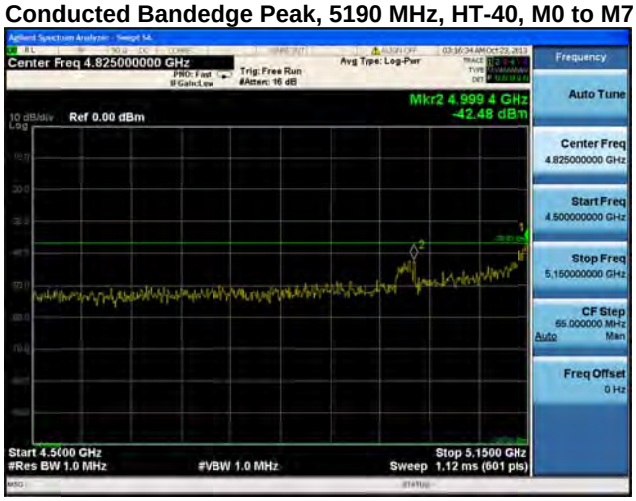



***Antenna A***



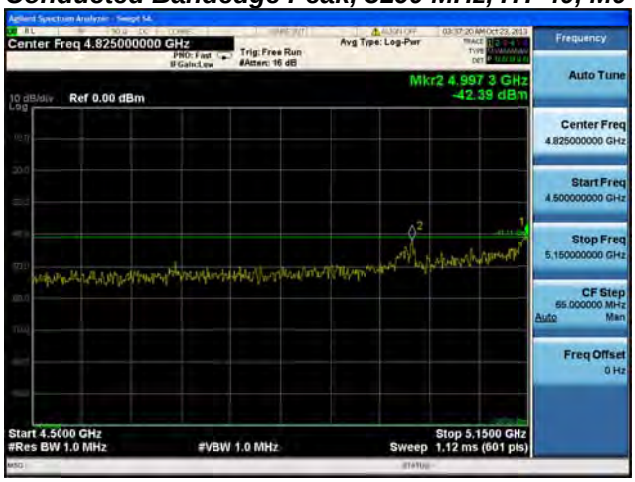

***Antenna B***

**Conducted Bandedge Peak, 5190 MHz, HT-40, M0 to M7**

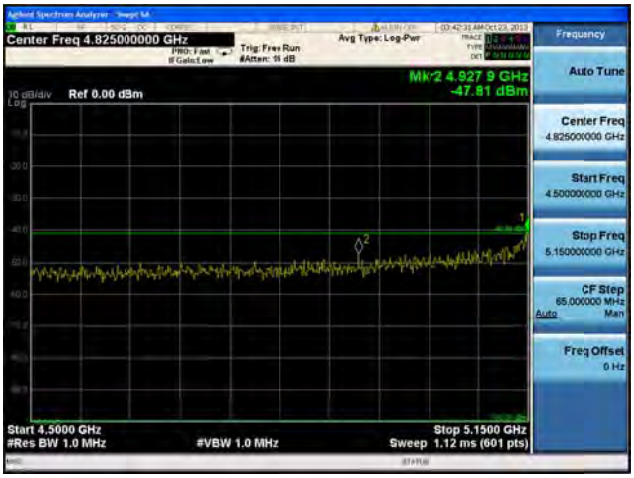



***Antenna A***

***Conducted Bandedge Peak, 5190 MHz, HT-40, M0 to M7***

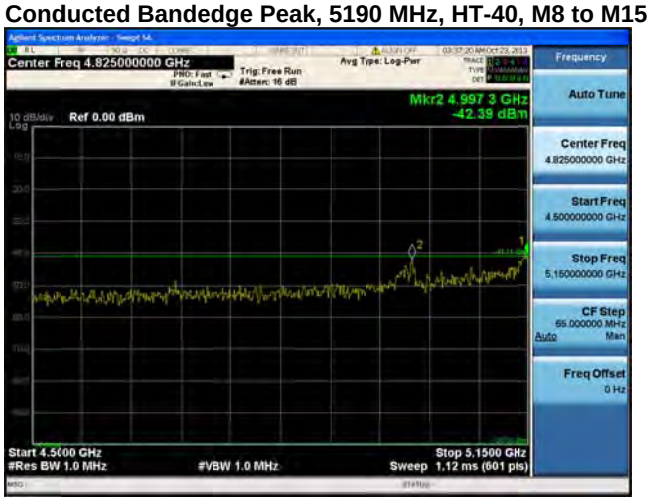



***Antenna A***

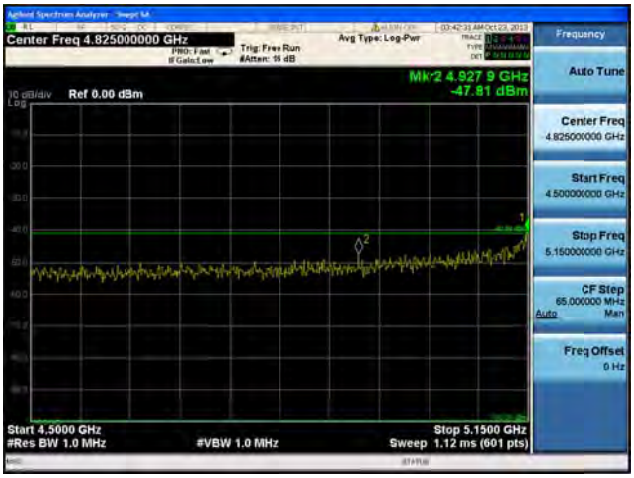



***Antenna B***

**Conducted Bandedge Peak, 5190 MHz, HT-40, M8 to M15**

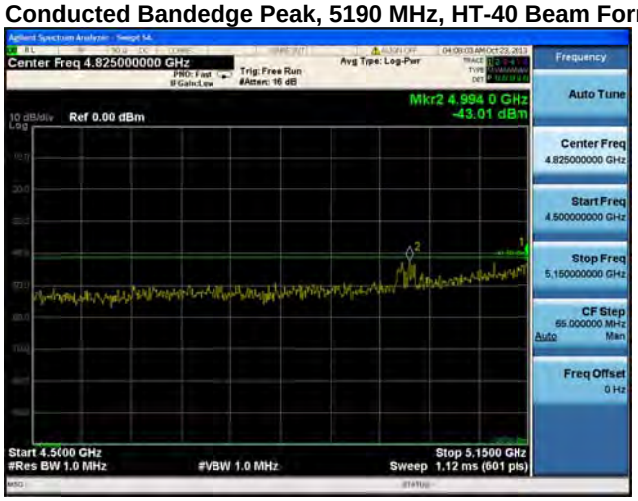



***Antenna A***

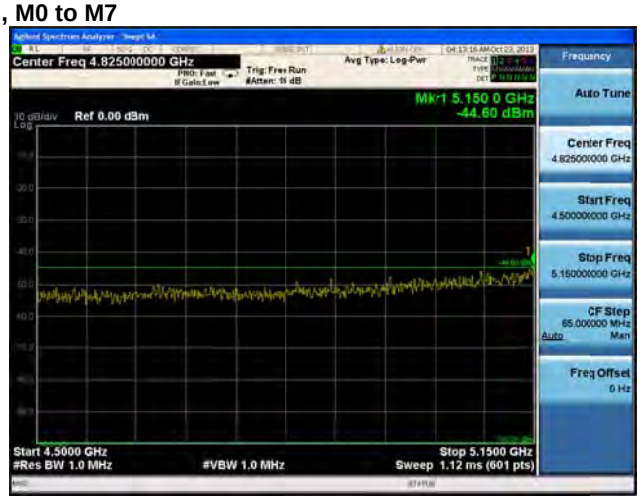



***Antenna B***

**Conducted Bandedge Peak, 5190 MHz, HT-40 Beam Forming, M0 to M7**

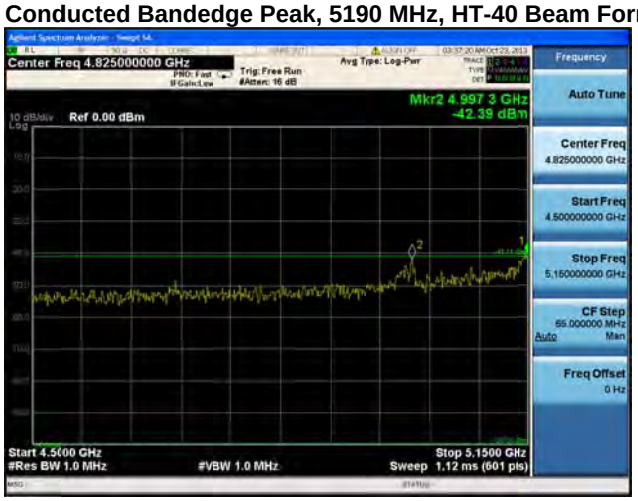



***Antenna A***

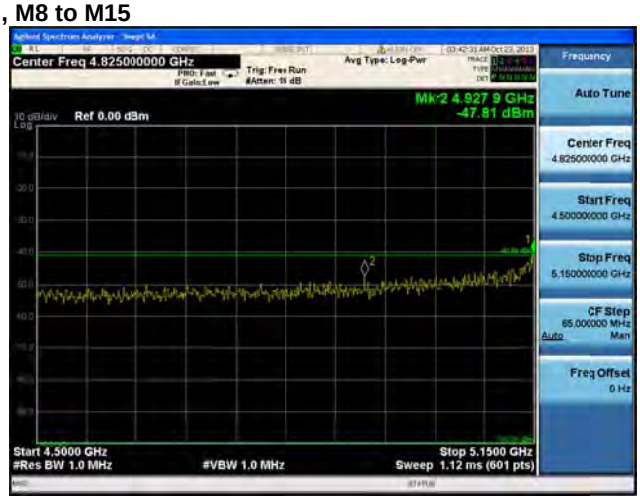



***Antenna B***

**Conducted Bandedge Peak, 5190 MHz, HT-40 Beam Forming, M8 to M15**

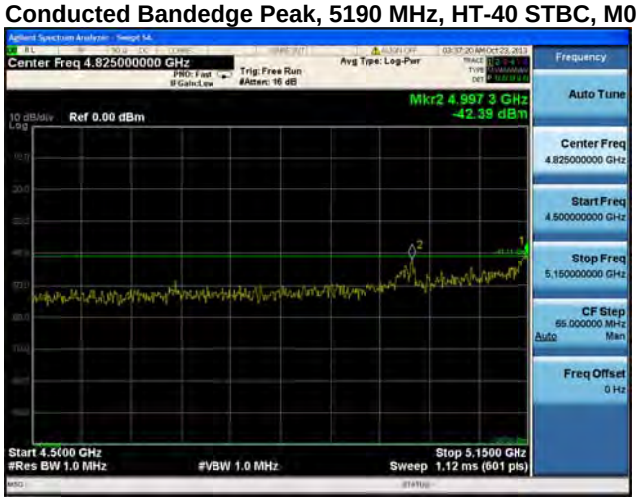



***Antenna A***

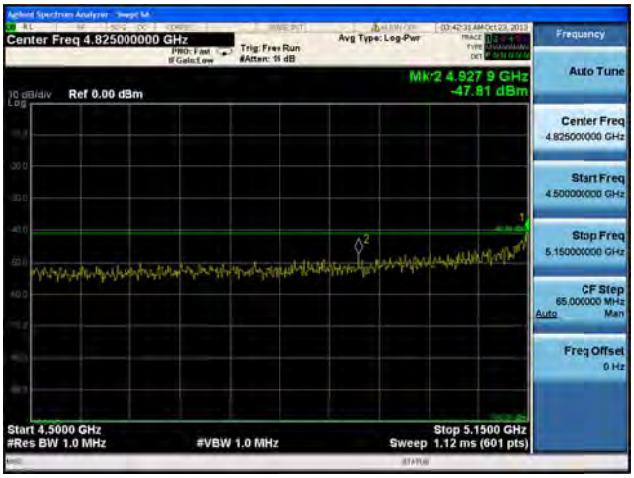



***Antenna B***

**Conducted Bandedge Peak, 5190 MHz, HT-40 STBC, M0 to M7**




***Antenna A***




***Antenna B***

**Appendix B: Emission Test Results**

**Testing Laboratory:** Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134, USA

# Radiated Spurious Emissions

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Using Vasona, configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer). Place the radio in continuous transmit mode.

| | |
|---|---|
| Span: | 1GHz – 18 GHz |
| Reference Level: | 80 dBuV |
| Attenuation: | 10 dB |
| Sweep Time: | Coupled |
| Resolution Bandwidth: | 1MHz |
| Video Bandwidth: | 1 MHz for peak, 10 Hz for average |
| Detector: | Peak |

Maximize Turntable (find worst case table angle), Maximize Antenna (find worst case height)

Save 2 plots: 1) Average Plot (Vertical and Horizontal), Limit= 54dBuV @3m
2) Peak plot (Vertical and Horizontal), Limit = 74dBuV @3m

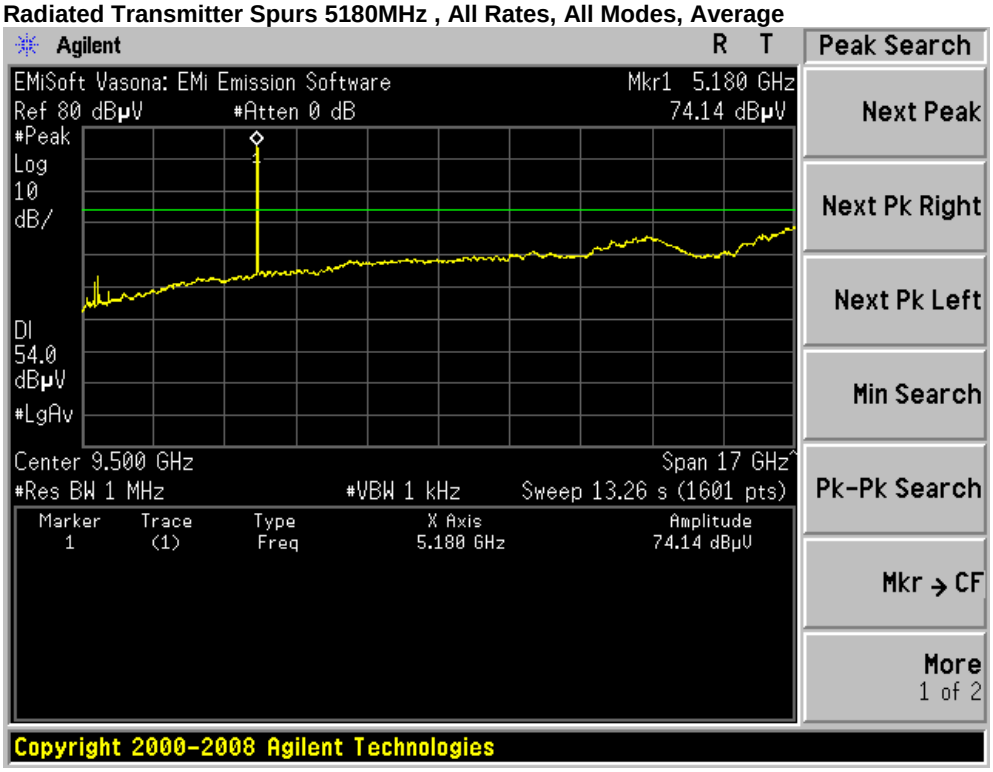
Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands.

This report represents the worst case data for all supported operating modes and antennas. There are no measurable emissions above 18 GHz.

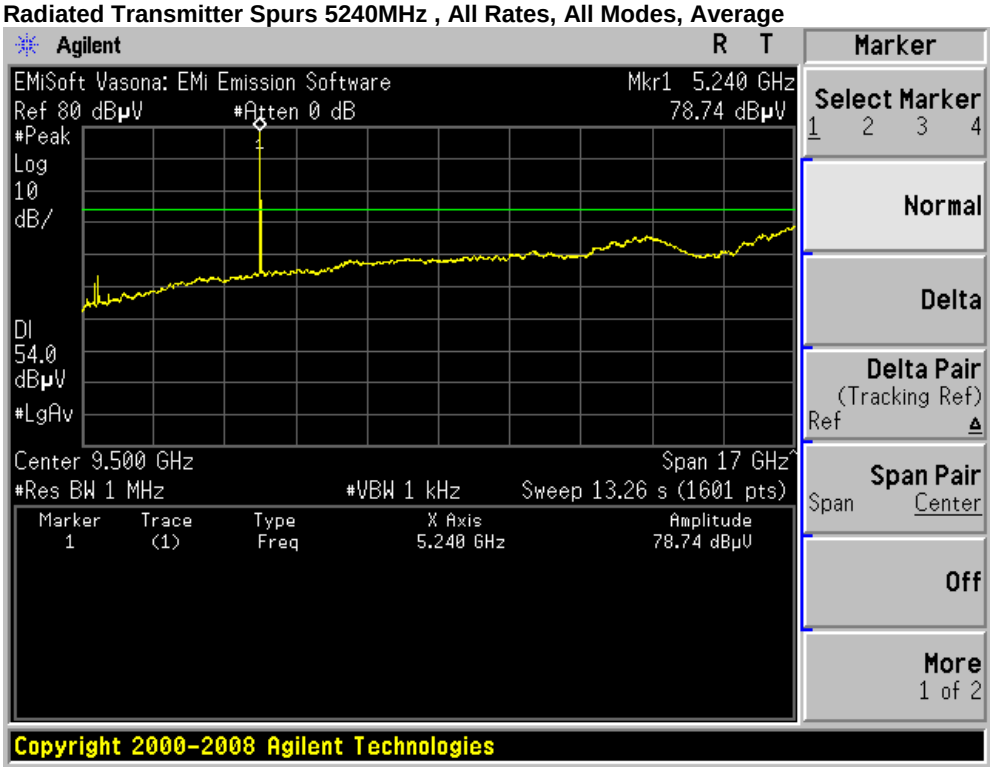
| Frequency (MHz) | Mode | Data Rate (Mbps) | Spurious Emission Level (dBuV/m) | Limit (dBuV/m) |
|---|---|---|---|---|
| 5180 | Non HT-20, 6 to 54 Mbps | 6 | **<54** | **54** |
| | Non HT-20 Beam Forming, 6 to 54 Mbps | 6 | **<54** | **54** |
| | HT-20, M0 to M23 | m0 | **<54** | **54** |
| | HT-20 STBC, M0 to M7 | m0 | **<54** | **54** |
| | HT-20 Beam Forming, M0 to M23 | m0 | **<54** | **54** |
| | | | | |
| 5240 | Non HT-20, 6 to 54 Mbps | 6 | **<54** | **54** |
| | Non HT-20 Beam Forming, 6 to 54 Mbps | 6 | **<54** | **54** |
| | HT-20, M0 to M23 | m0 | **<54** | **54** |
| | HT-20 STBC, M0 to M7 | m0 | **<54** | **54** |
| | HT-20 Beam Forming, M0 to M23 | m0 | **<54** | **54** |
| | | | | |
| 5180/5200 | Non HT-40 Duplicate, 6-54 Mbps | 6 | **<54** | **54** |
| | HT-40, M0 to M23 | 6 | **<54** | **54** |
| | HT-40 STBC, M0 to M7 | m0 | **<54** | **54** |
| | HT-40 Beam Forming, M0 to M23 | m0 | **<54** | **54** |
| | | | | |
| 5220/5240 | Non HT-40 Duplicate, 6-54 Mbps | 6 | **<54** | **54** |
| | HT-40, M0 to M23 | m0 | **<54** | **54** |
| | HT-40 STBC, M0 to M7 | m0 | **<54** | **54** |
| | HT-40 Beam Forming, M0 to M23 | m0 | **<54** | **54** |

## Transmitter Radiated Spurious Emissions

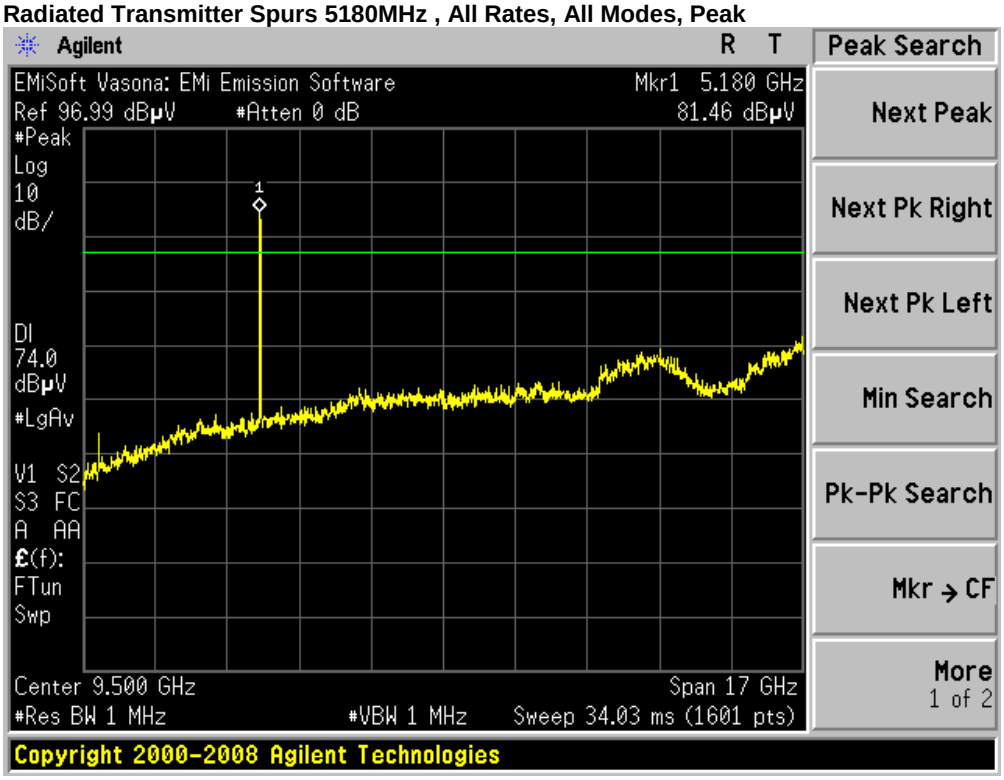
**Radiated Transmitter Spurs 5180MHz , All Rates, All Modes, Average**



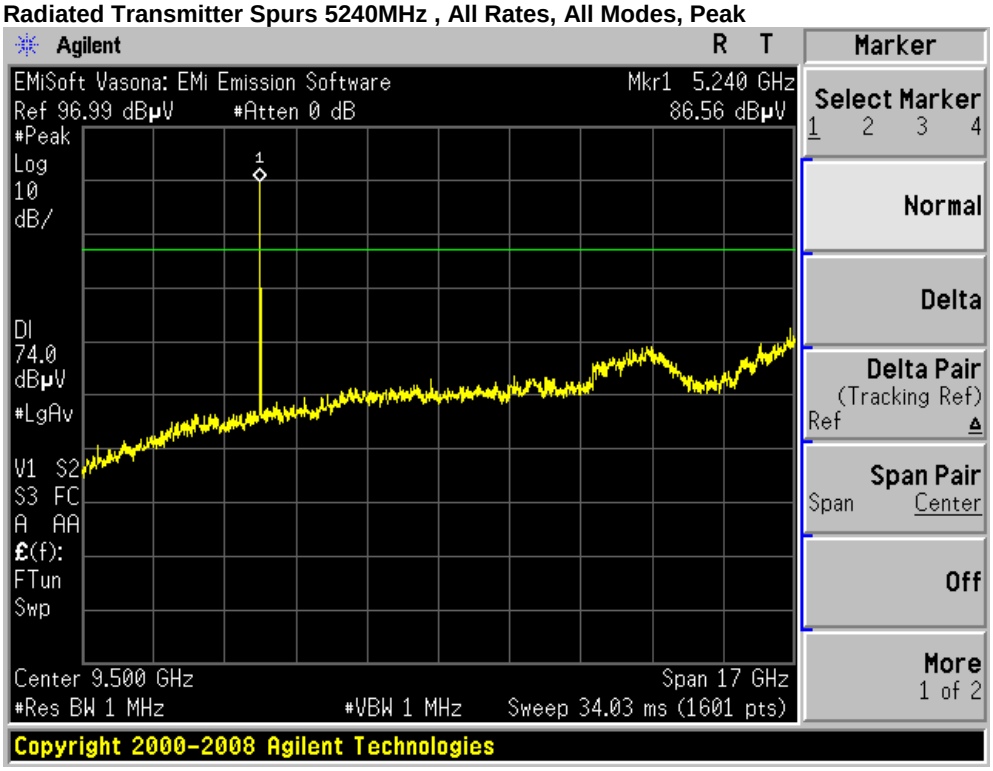

**Radiated Transmitter Spurs 5240MHz , All Rates, All Modes, Average**



**Radiated Transmitter Spurs 5180MHz , All Rates, All Modes, Peak**



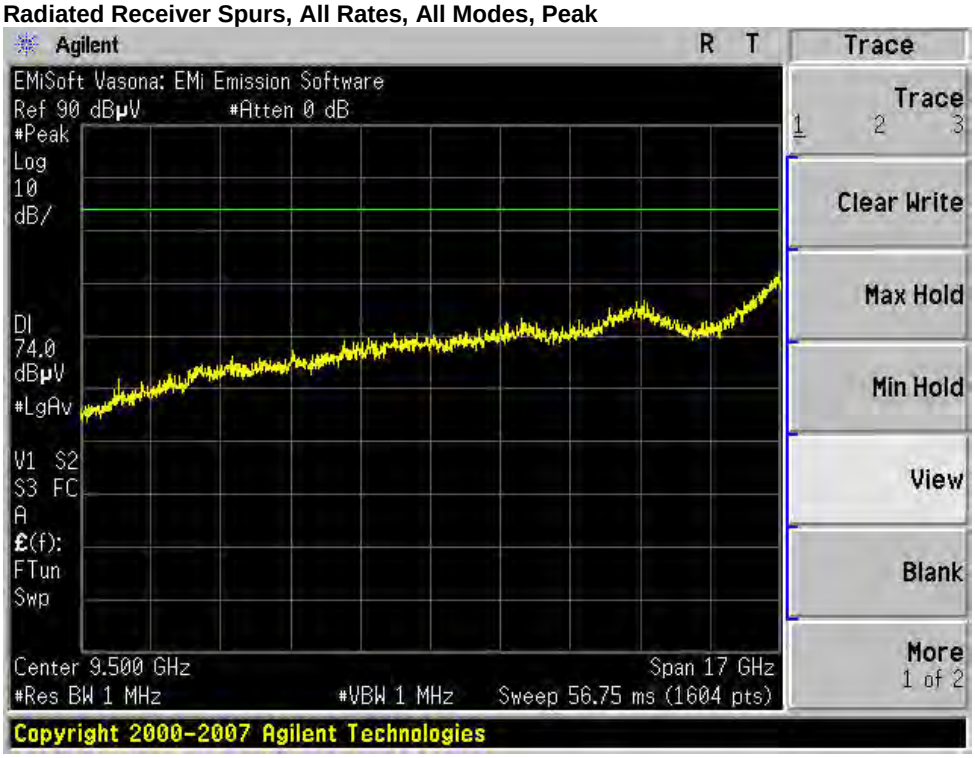

**Radiated Transmitter Spurs 5240MHz , All Rates, All Modes, Peak**

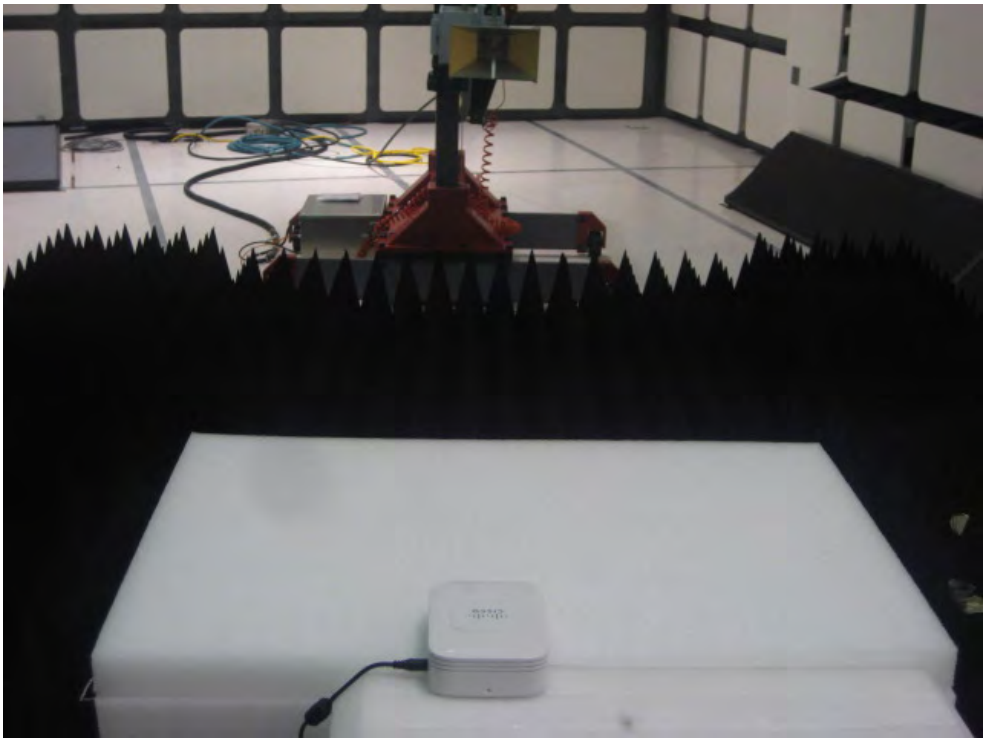


## Receiver Radiated Spurious Emissions

**Radiated Receiver Spurs, All Rates, All Modes, Average**


**Radiated Receiver Spurs, All Rates, All Modes, Peak**





Radiated Test Setup

# Maximum Permissible Exposure (MPE) Calculations

15.407: U-NII devices are subject to the radio frequency radiation exposure requirements specified in Sec. 1.1307(b), Sec. 2.1091 and Sec. 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a ``general population/uncontrolled'' environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

Given

E=√(30*P*G)/d and S=E^2/3770

where

E=Field Strength in Volts/meter
P=Power in Watts
G=Numeric Antenna Gain
d=Distance in meters
S=Power Density in mW/cm^2

Combine equations and rearrange the terms to express the distance as a function of the remaining variables:

d=√((30*P*G)/(3770*S))

Changing to units of power in mW and distance in cm, using:

P(mW)=P(W)/1000 d(cm)=100*d(m)

yields

d=100*√((30*(P/1000)*G)/(3770*S))
d=0.282*√(P*G/S)

where

d=Distance in cm
P=Power in mW
G=Numerica Antenna Gain
S=Power Density in mW/cm^2

Substituting the logarithmic form of power and gain using:

P(mW)=10^(P(dBm)/10) G(numeric)=10^(G(dBi)/10)

yields

d=0.282*10^((P+G)/20)/√S Equation (1)

and

s=((0.282*10^((P+G)/20))/d)^2 Equation (2)

where

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

Equation (1) and the measured peak power are used to calculate the MPE distance. Note that for mobile or fixed location transmitters such as an access point, the minimum separation distance is 20 cm even if the calculations indicate that the MPE distance may be less.

S=1mW/cm^2 maximum. The highest supported antenna gain is 4 dBi (7dBi with beamforming). Using the peak power levels recorded in the test report along with Equation 1 above, the MPE distances are calculated as follows.

**MPE Calculations:**

| Frequency (MHz) | Power Density (mW/cm^2) | Peak Transmit Power (dBm) | Antenna Gain (dBi) | MPE Distance (cm) | Limit (cm) | Margin (cm) |
|---|---|---|---|---|---|---|
| 5180 | 1 | 12.9 | 7 | **2.79** | 20 | 17.21 |
| 5230 | 1 | 17.0 | 4 | **3.16** | 20 | 16.84 |

To maintain compliance, installations will assure a separation distance of at least 20cm.

Using Equation 2, the MPE levels (s) at 20 cm are calculated as follows:

| Frequency (MHz) | MPE Distance (cm) | Peak Transmit Power (dBm) | Antenna Gain (dBi) | Power Density (mW/cm^2) | Limit (mW/cm^2) | Margin (mW/cm^2) |
|---|---|---|---|---|---|---|
| 5180 | 20 | 12.9 | 7 | **0.02** | 1 | 0.98 |
| 5230 | 20 | 17.0 | 4 | **0.03** | 1 | 0.97 |

## Appendix C: Test Equipment/Software Used to perform the test

| Equip # | Manufacturer | Model | Description | Last Cal | Next Due |
|---|---|---|---|---|---|
| CIS-50378 | Agilent | N9030A | PXA Spectrum Analyzer | 2/27/2013 | 2/27/2014 |