



## **Test Report**

# **AIR-CAP1532I-A-K9**

## **Cisco Aironet 802.11n Dual Band Mesh Access Points**

**FCC ID: LDK102090P**

**IC: 2461B-102090P**

Also covers:

AIR-CAP1532I -N-K9

AIR- CAP1532I -T-K9

AIR- CAP1532I -Z-K9

## **2400-2483.5 MHz**

**Against the following Specifications:**

**CFR47 Part 15.247**

**RSS210**

**LP0002**

**Cisco Systems**

170 West Tasman Drive

San Jose, CA 95134



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## Section 1: Overview

### 1.1 Test Summary

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

| Emission                    | Immunity |
|-----------------------------|----------|
| CFR47 Part 15.247<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%) |

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## **2.2 Date of testing**

12 July 2013

## **2.3 Report Issue Date**

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## **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**

James Nicholson, Bud Chiller

## **2.5 Equipment Assessed (EUT)**

AIR-CAP1532I-A-K9 Cisco Aironet 802.11n Mesh Access Point



## 2.6 EUT Description

The 1532I Series Cisco Aironet 802.11n Dual Band Mesh Access Points 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.

Legacy CCK, One Antenna, 1 to 11 Mbps  
Legacy CCK, Two Antennas, 1 to 11 Mbps  
Legacy CCK, Three Antennas, 1 to 11 Mbps

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

HT-20, One Antenna, M0 to M7  
HT-20, Two Antennas, M0 to M15  
HT-20, Three Antennas, M0 to M23

HT-20 STBC, Two Antennas, M0 to M7  
HT-20 STBC, Three 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) |
|------------------|-------------|--------------------|--------------------|
| <b>2.4/5 GHz</b> | Internal    | Dual-resonant Omni | 3 / 5              |



## 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-CAP1532I-A-K9 |             | Cisco Systems | NA            | NA            | NA            |               |
| S02        | PoE supply        | 9501GO      | Microsemi     | NA            | NA            | NA            |               |

### 4.2 System Details

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

### 4.3 Mode of Operation Details

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

All tests in this report were performed as described in FCC KDB 662911 D01

**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.

| Operating Mode           | Maximum Channel Power (dBm) |      |      |
|--------------------------|-----------------------------|------|------|
|                          | Frequency (MHz)             |      |      |
|                          | 2412                        | 2437 | 2462 |
| Legacy CCK, 1 to 11 Mbps | 28                          | 29   | 26   |
| Non HT-20, 6 to 54 Mbps  | 17                          | 24   | 18   |
| HT-20, M0 to M23         | 17                          | 24   | 18   |
| HT-20 STBC, M0 to M7     | 17                          | 24   | 18   |



## 6dB Bandwidth

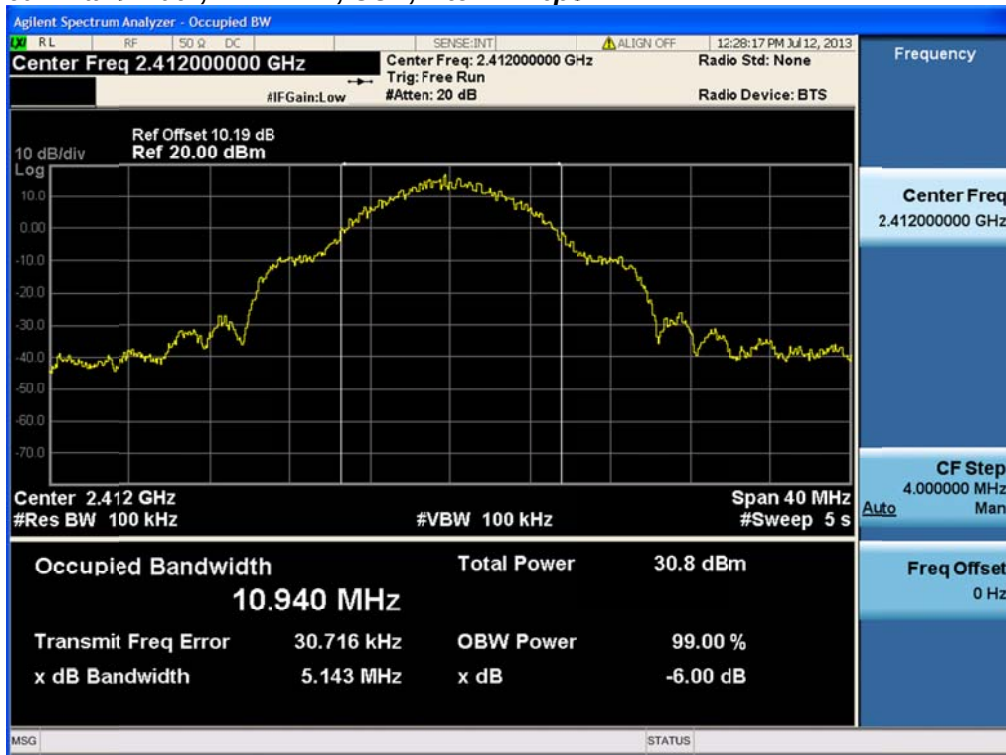
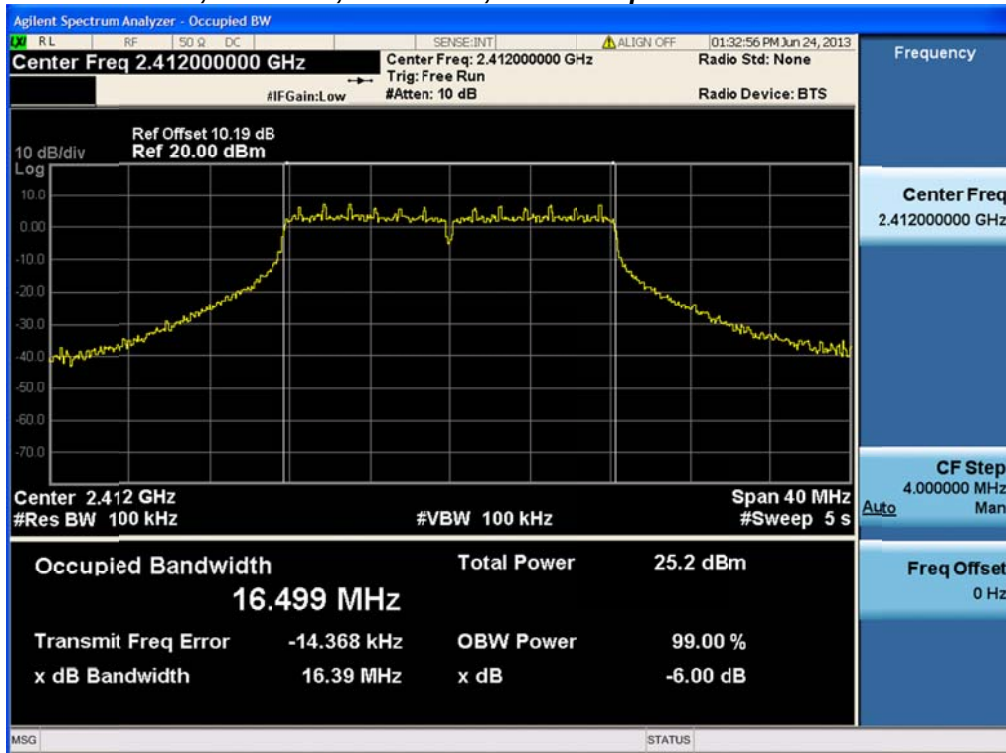
15.247 / RSS-210 A8.2: Systems using digital modulation techniques may operate in the 2400-2483.5MHz band. The minimum 6 dB bandwidth shall be at least 500 kHz.

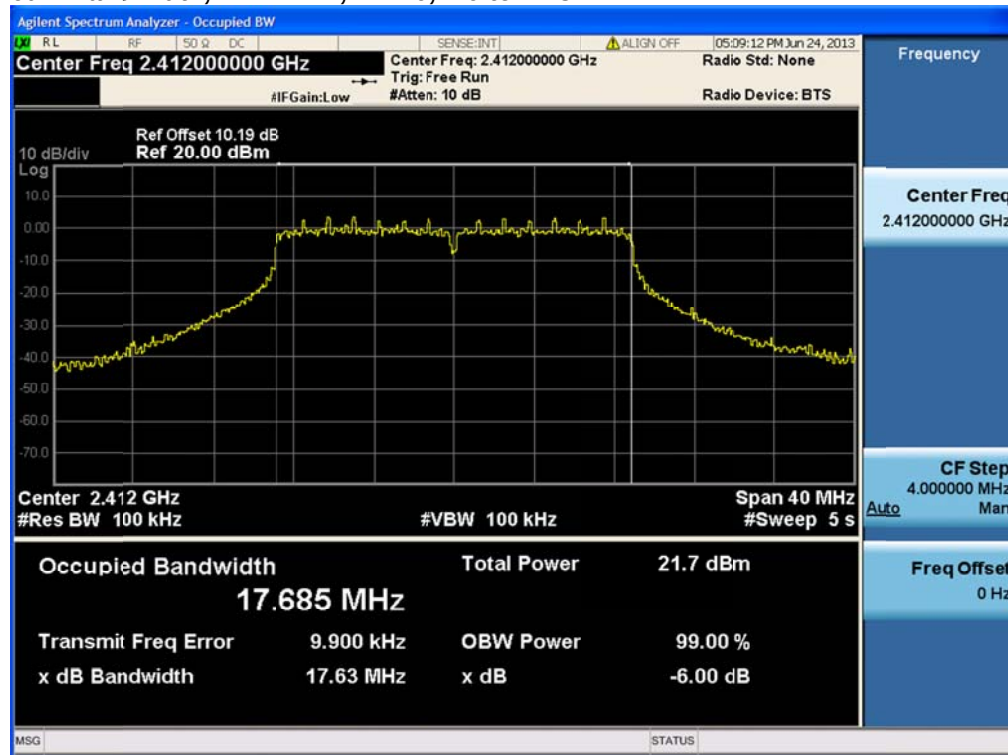
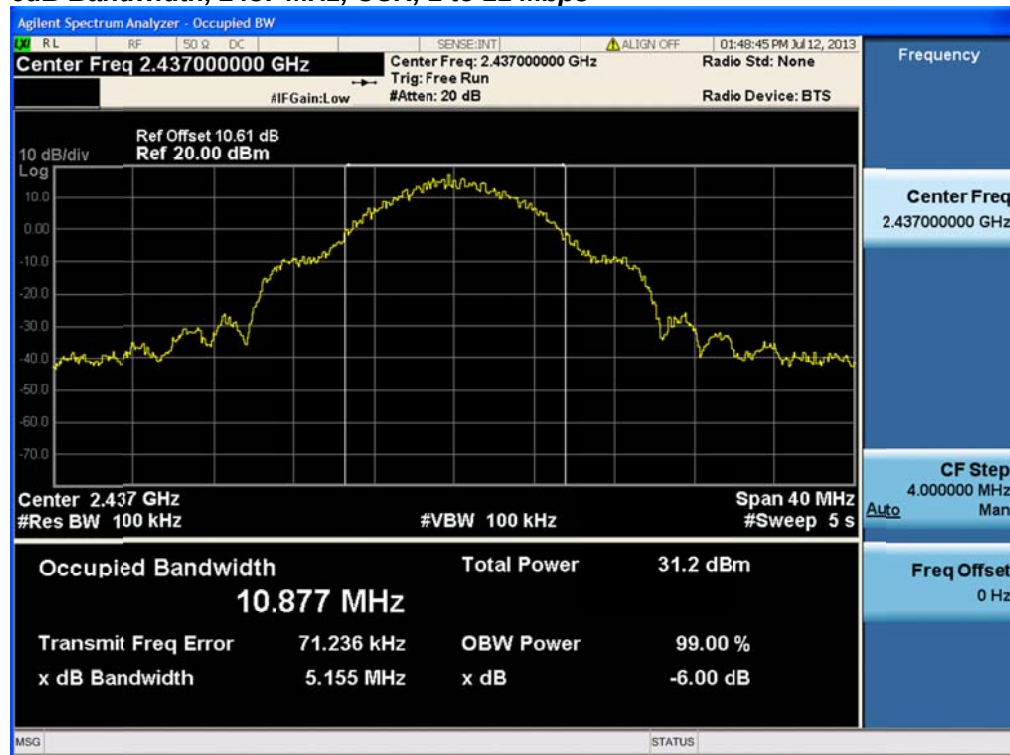
Connect the antenna port(s) to the spectrum analyzer input. Using the spectrum analyzer Channel Bandwidth mode, configure the spectrum analyzer as shown below (enter all losses between the transmitter output and the spectrum analyzer).

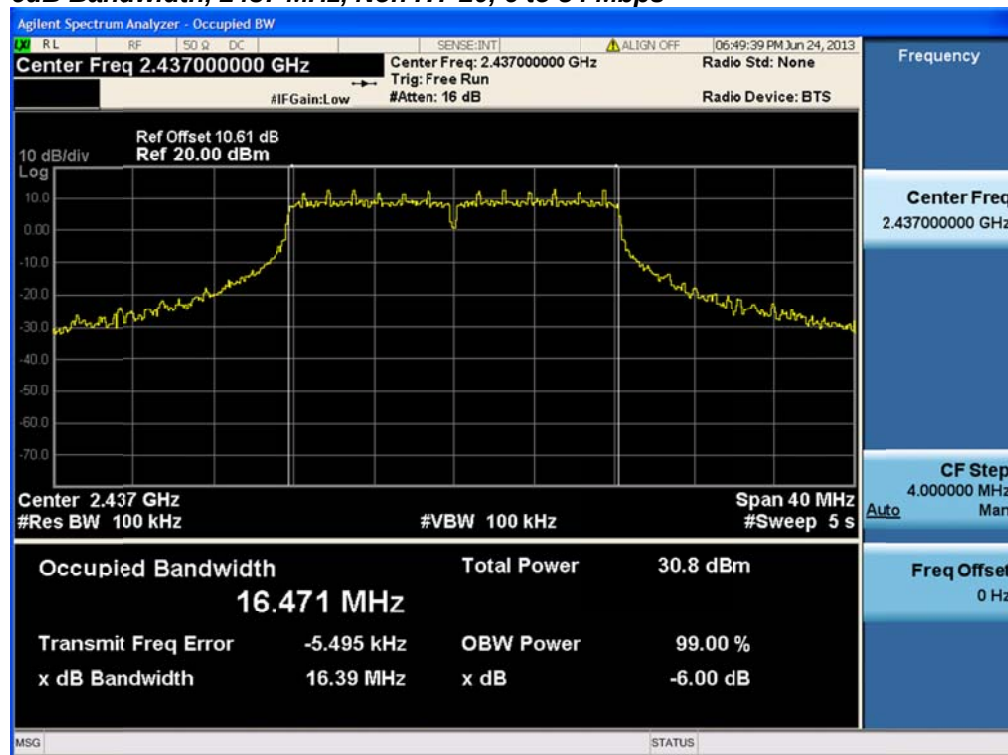
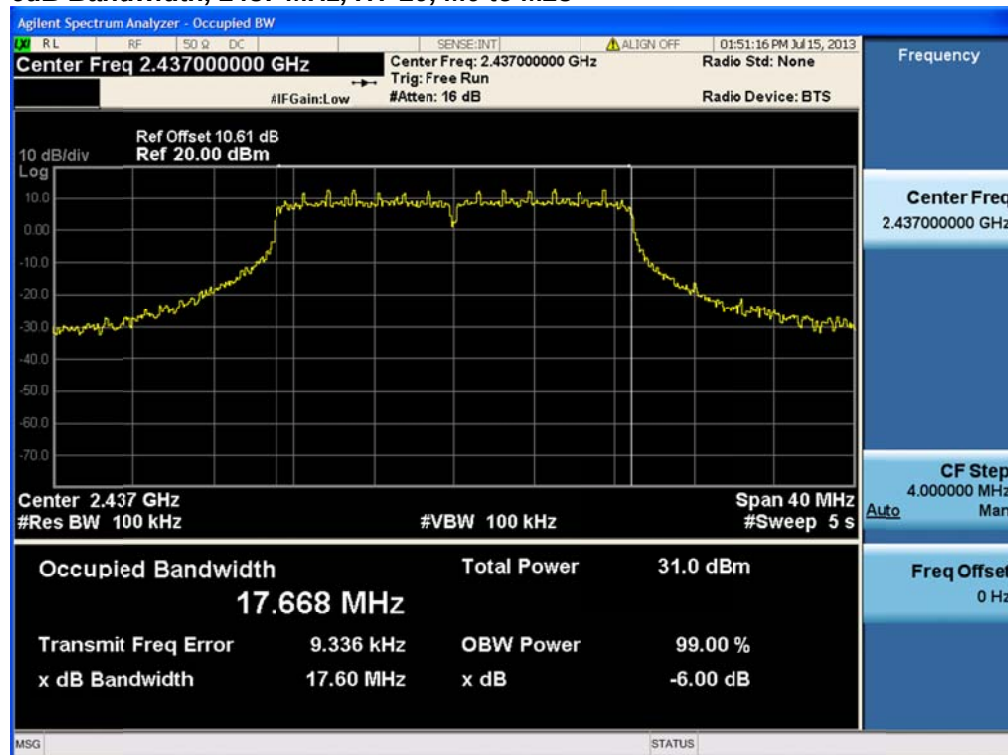
|                       |                                                        |
|-----------------------|--------------------------------------------------------|
| Center Frequency:     | Frequency from table below                             |
| Span:                 | 2 x Nominal Bandwidth (e.g. 40MHz for a 20MHz channel) |
| Reference Level:      | 20 dBm                                                 |
| Attenuation:          | 10 dB                                                  |
| Sweep Time:           | 5 s                                                    |
| Resolution Bandwidth: | 100 kHz                                                |
| Video Bandwidth:      | 100 kHz                                                |
| X dB Bandwidth:       | 6 dB                                                   |
| Detector:             | Peak                                                   |
| Trace:                | Single                                                 |

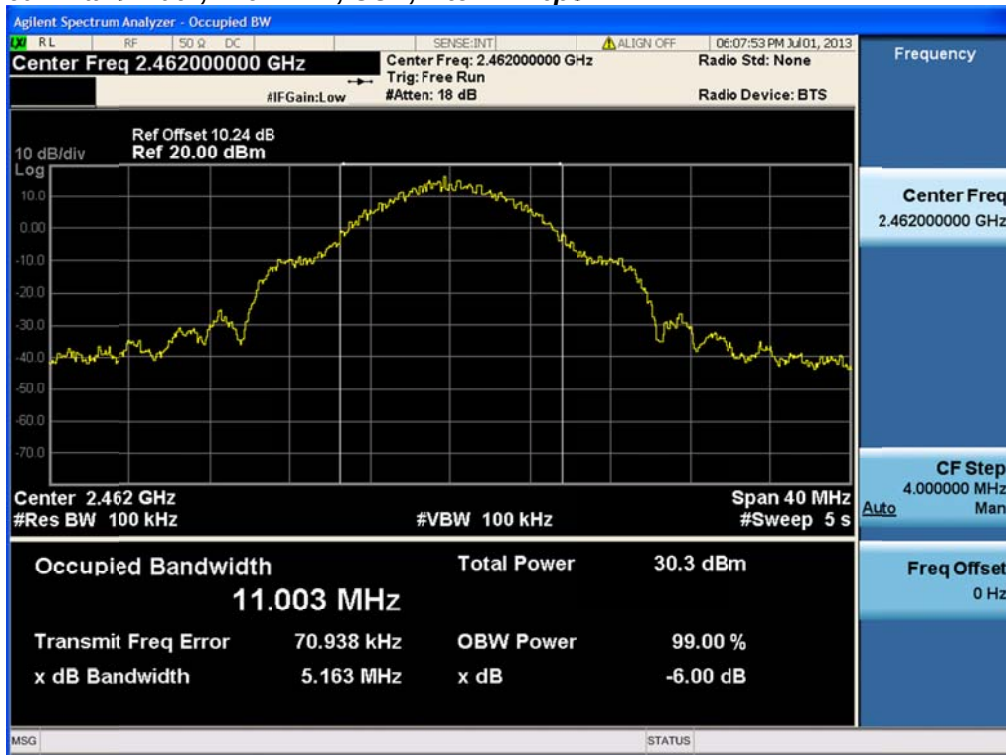
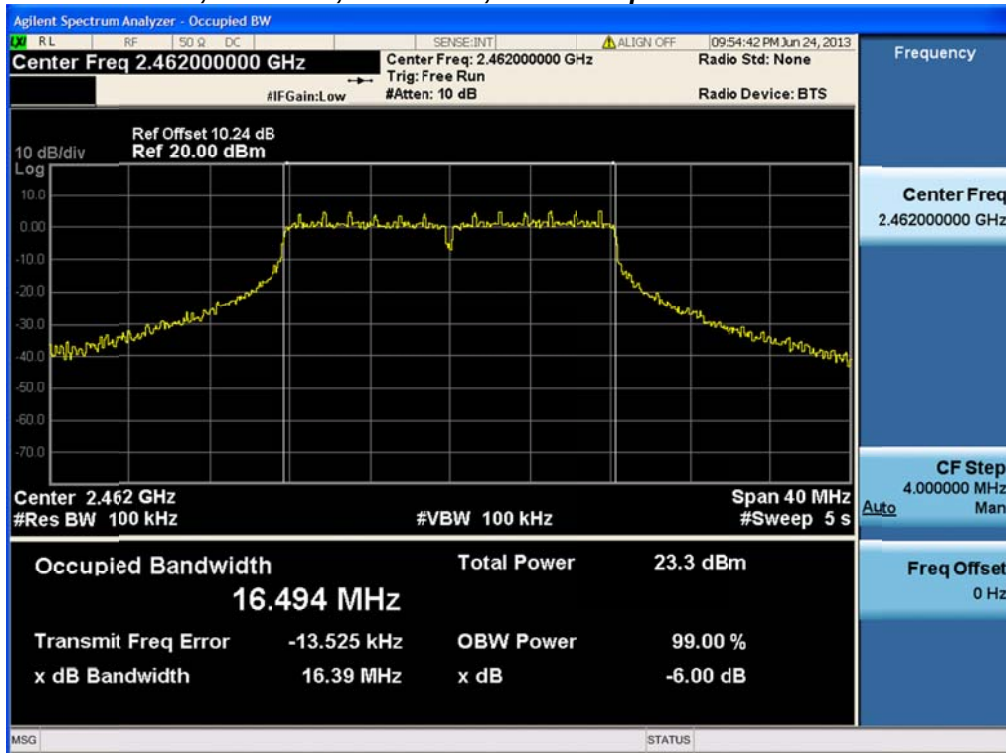
Place the radio in continuous transmit mode. View the transmitter waveform on the spectrum analyzer, and record the pertinent measurements:

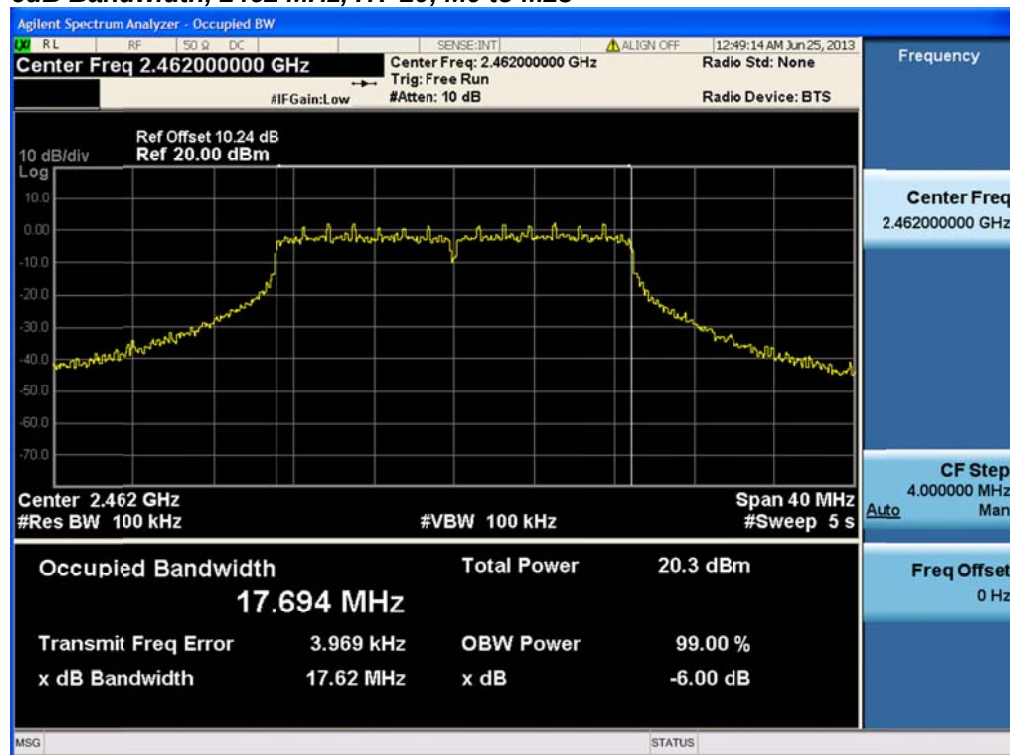
| Frequency (MHz) | Mode                    | Data Rate (Mbps) | 6dB BW (MHz) | Limit (kHz) | Margin (MHz) |
|-----------------|-------------------------|------------------|--------------|-------------|--------------|
| 2412            | CCK, 1 to 11 Mbps       | 11               | 5.2          | >500        | 4.7          |
|                 | Non HT-20, 6 to 54 Mbps | 6                | 16.4         | >500        | 15.9         |
|                 | HT-20, M0 to M23        | m0               | 17.6         | >500        | 17.1         |
| 2437            | CCK, 1 to 11 Mbps       | 11               | 5.2          | >500        | 4.7          |
|                 | Non HT-20, 6 to 54 Mbps | 6                | 16.4         | >500        | 15.9         |
|                 | HT-20, M0 to M23        | m0               | 17.6         | >500        | 17.1         |
| 2462            | CCK, 1 to 11 Mbps       | 11               | 5.2          | >500        | 4.7          |
|                 | Non HT-20, 6 to 54 Mbps | 6                | 16.4         | >500        | 15.9         |
|                 | HT-20, M0 to M23        | m0               | 17.6         | >500        | 17.1         |

**6dB Bandwidth, 2412 MHz, CCK, 1 to 11 Mbps****6dB Bandwidth, 2412 MHz, Non HT-20, 6 to 54 Mbps**

**6dB Bandwidth, 2412 MHz, HT-20, M0 to M23****6dB Bandwidth, 2437 MHz, CCK, 1 to 11 Mbps**

**6dB Bandwidth, 2437 MHz, Non HT-20, 6 to 54 Mbps****6dB Bandwidth, 2437 MHz, HT-20, M0 to M23**

**6dB Bandwidth, 2462 MHz, CCK, 1 to 11 Mbps****6dB Bandwidth, 2462 MHz, Non HT-20, 6 to 54 Mbps**

**6dB Bandwidth, 2462 MHz, HT-20, M0 to M23**



## 99% and 26dB Bandwidth

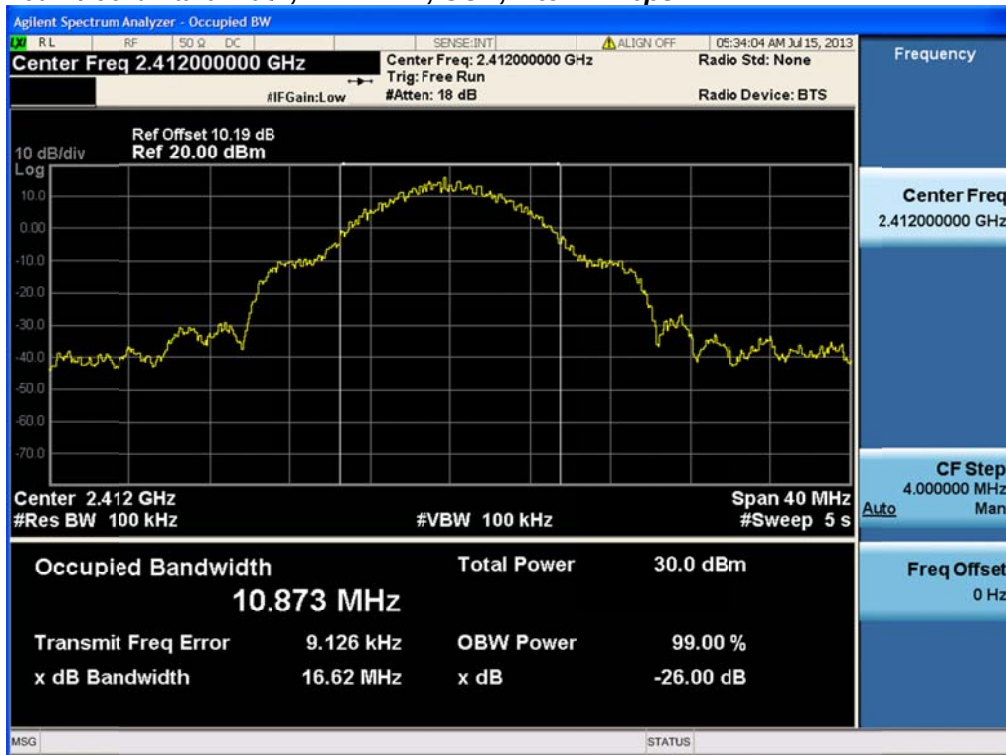
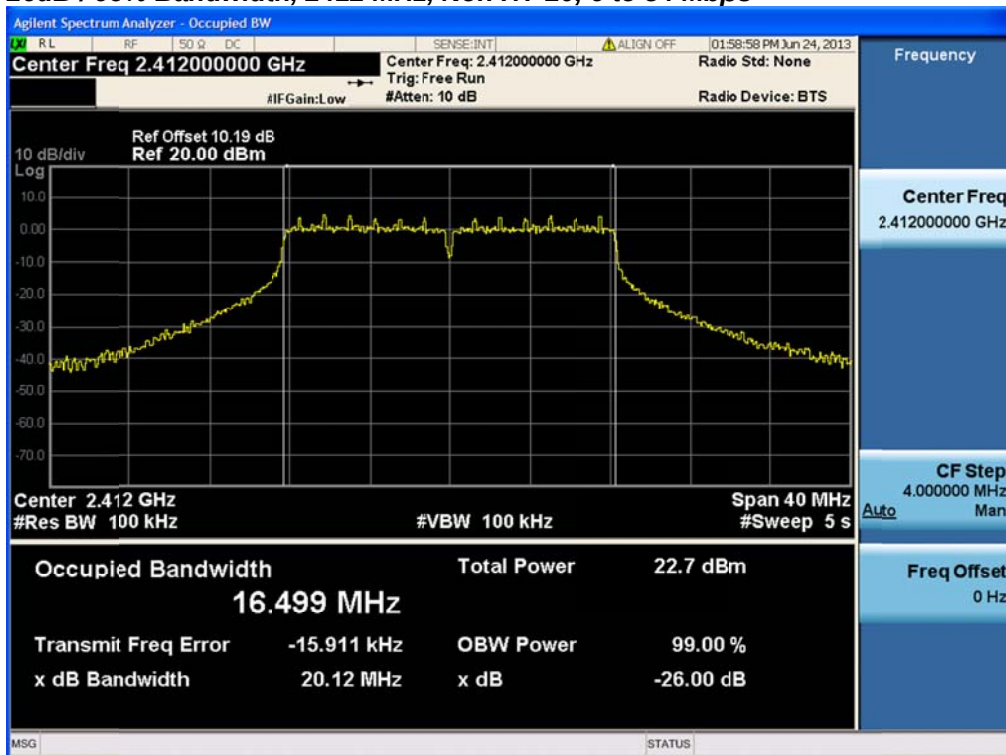
Connect the antenna port(s) to the spectrum analyzer input. Using the spectrum analyzer Channel Bandwidth mode, configure the spectrum analyzer as shown below (enter all losses between the transmitter output and the spectrum analyzer).

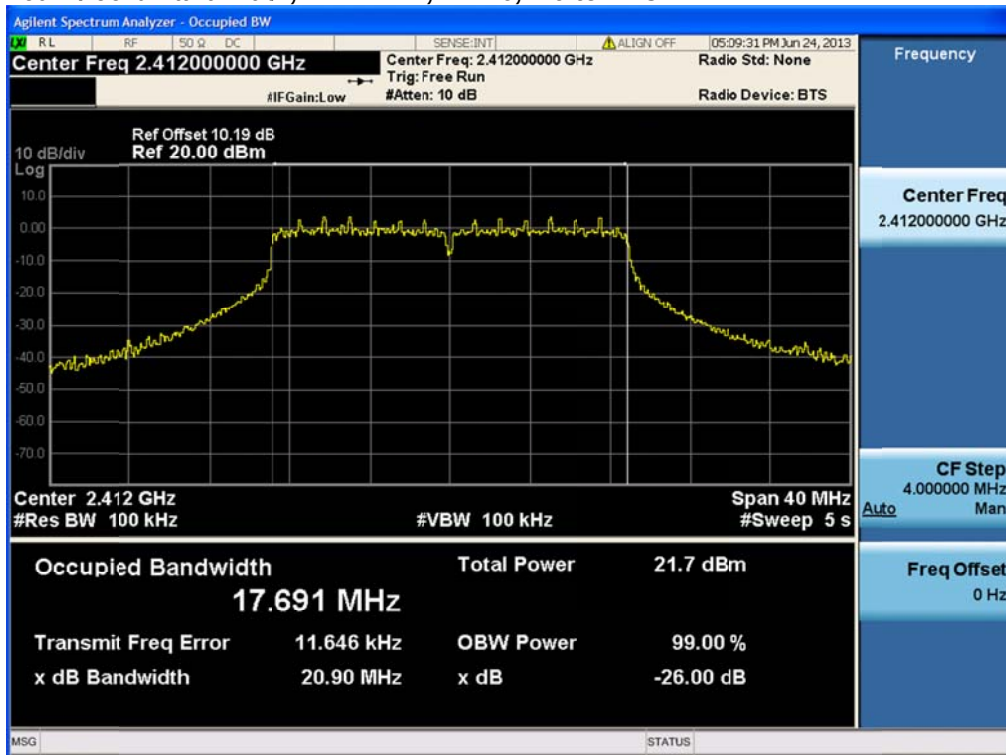
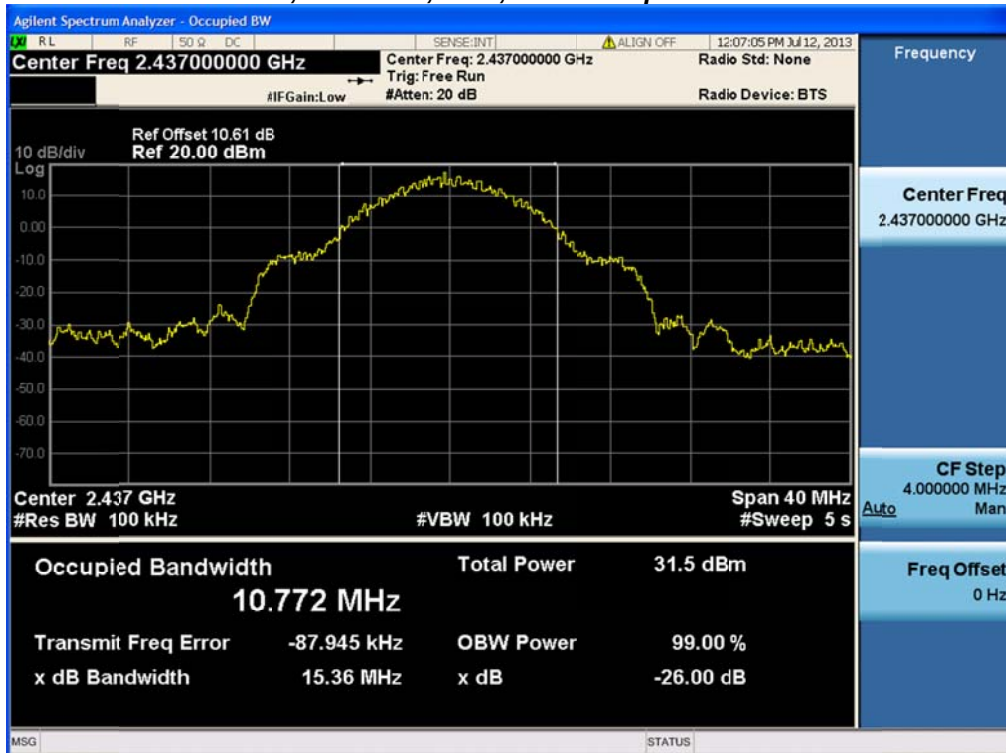
|                       |                                                        |
|-----------------------|--------------------------------------------------------|
| Center Frequency:     | Frequency from table below                             |
| Span:                 | 2 x Nominal Bandwidth (e.g. 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                                                 |

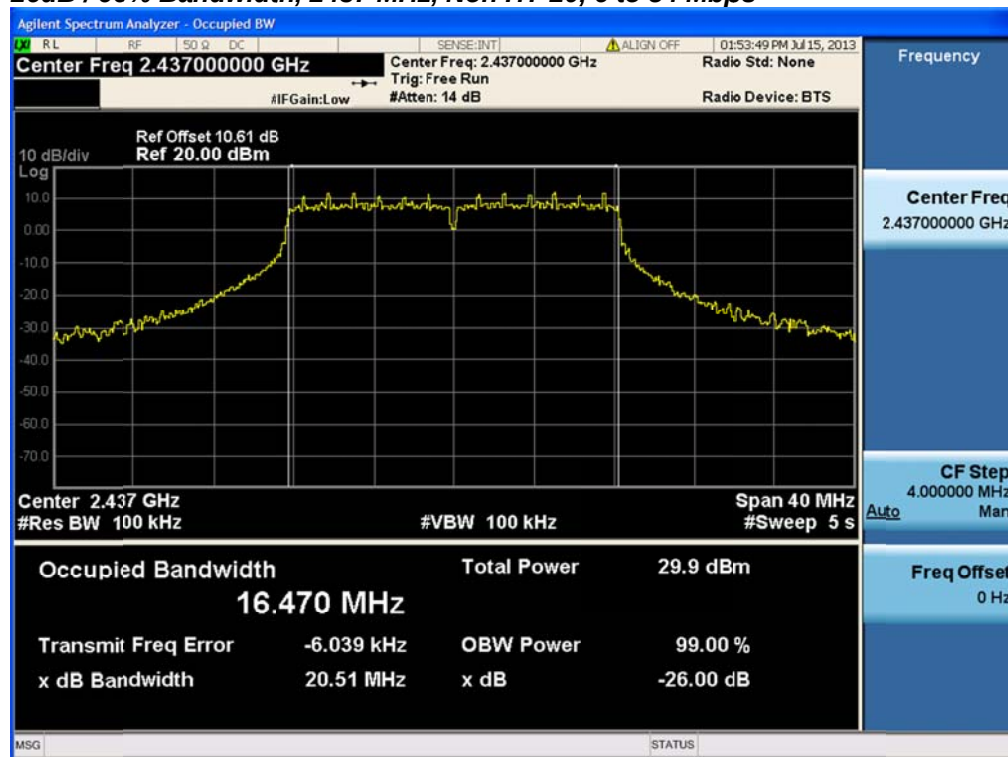
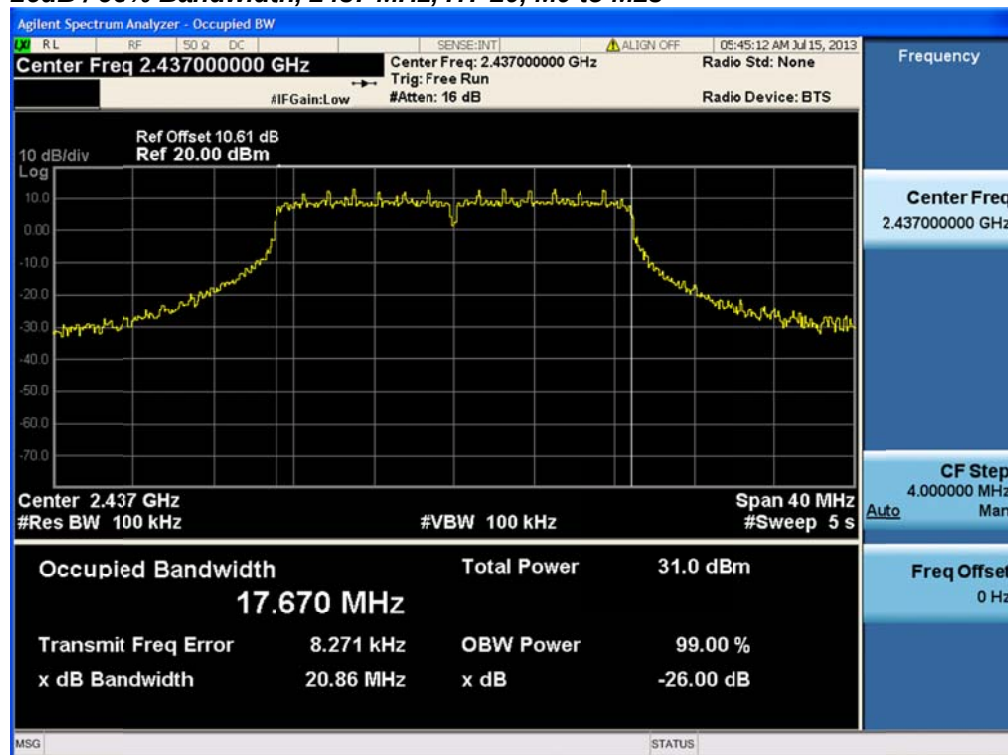
Place the radio in continuous transmit mode. View the transmitter waveform on the spectrum analyzer, and record the pertinent measurements:

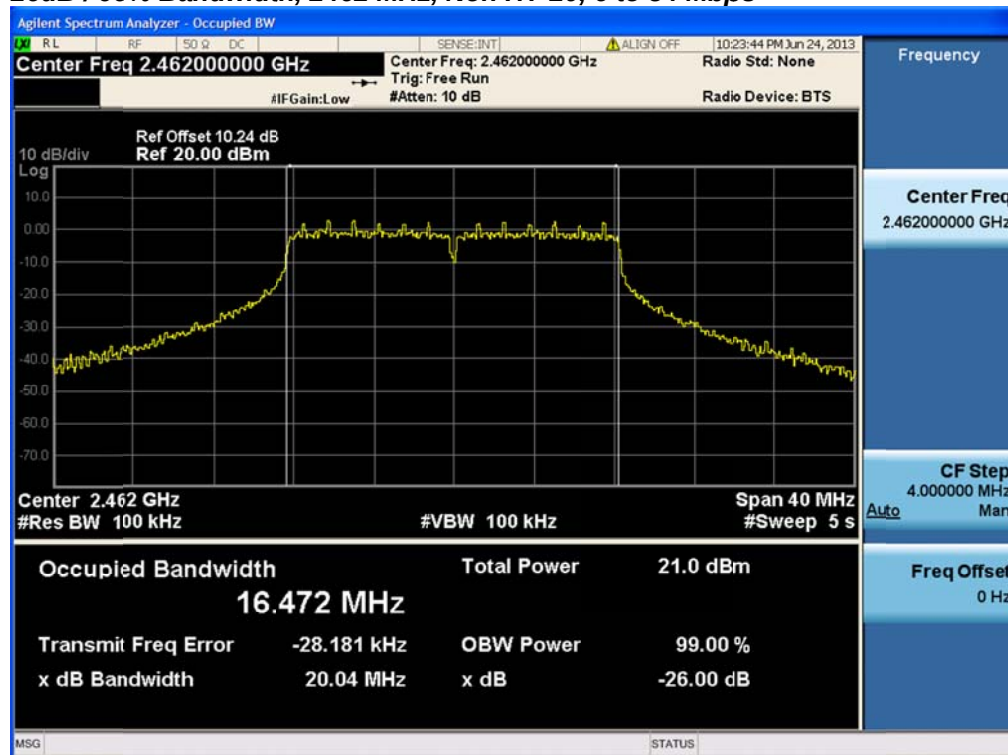


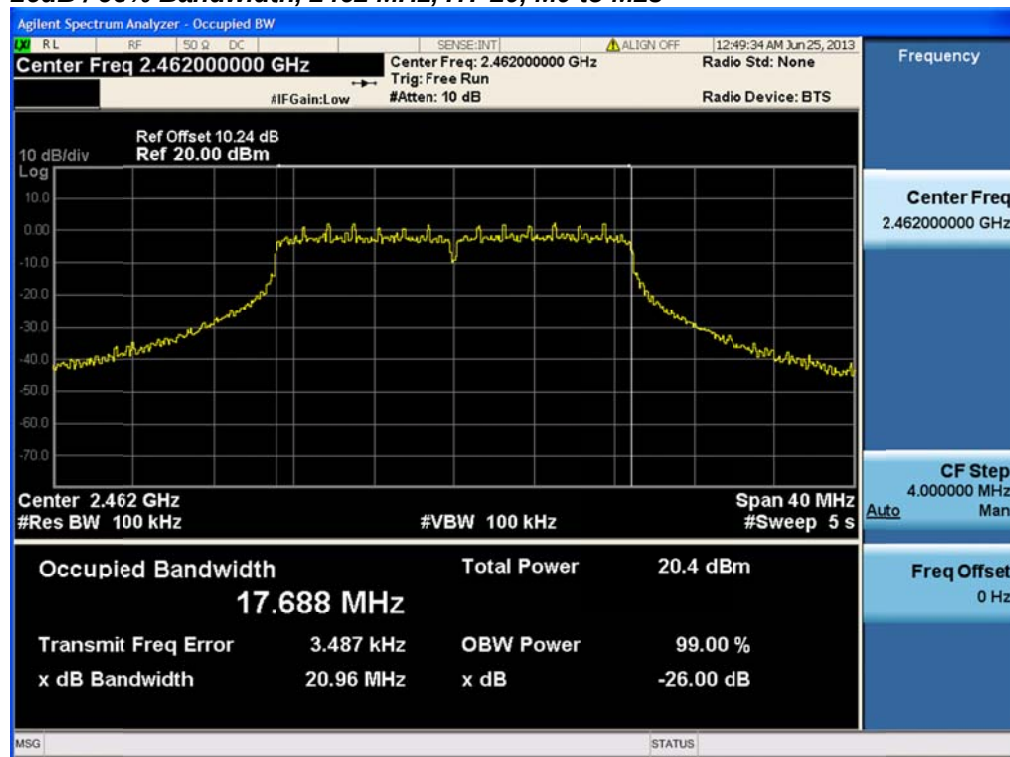
| Frequency (MHz) | Mode                    | Data Rate (Mbps) | 26dB BW (MHz) | 99% BW (MHz) |
|-----------------|-------------------------|------------------|---------------|--------------|
| 2412            | CCK, 1 to 11 Mbps       | 11               | 17.1          | 10.9         |
|                 | Non HT-20, 6 to 54 Mbps | 6                | 20.1          | 16.5         |
|                 | HT-20, M0 to M23        | m0               | 20.9          | 17.7         |
| 2437            | CCK, 1 to 11 Mbps       | 11               | 15.4          | 10.8         |
|                 | Non HT-20, 6 to 54 Mbps | 6                | 20.5          | 16.5         |
|                 | HT-20, M0 to M23        | m0               | 21            | 17.7         |
| 2462            | CCK, 1 to 11 Mbps       | 11               | 16.6          | 10.8         |
|                 | Non HT-20, 6 to 54 Mbps | 6                | 20            | 16.5         |
|                 | HT-20, M0 to M23        | m0               | 21            | 17.7         |

**26dB / 99% Bandwidth, 2412 MHz, CCK, 1 to 11 Mbps****26dB / 99% Bandwidth, 2412 MHz, Non HT-20, 6 to 54 Mbps**

**26dB / 99% Bandwidth, 2412 MHz, HT-20, M0 to M23****26dB / 99% Bandwidth, 2437 MHz, CCK, 1 to 11 Mbps**

**26dB / 99% Bandwidth, 2437 MHz, Non HT-20, 6 to 54 Mbps****26dB / 99% Bandwidth, 2437 MHz, HT-20, M0 to M23**

**26dB / 99% Bandwidth, 2462 MHz, CCK, 1 to 11 Mbps****26dB / 99% Bandwidth, 2462 MHz, Non HT-20, 6 to 54 Mbps**

**26dB / 99% Bandwidth, 2462 MHz, HT-20, M0 to M23**



## Peak Output Power

15.247 / RSS-210 A8.4: The maximum conducted output power of the intentional radiator for systems using digital modulation in the 2400-2483.5 MHz band shall not exceed 1 Watt (30dBm). 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 maximum supported antenna gain is 3dBi. 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.

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:                             | =26 dB BW from 26 dB Bandwidth Data                               |

After averaging 100 traces of the transmitter waveform on the spectrum analyzer, record the spectrum analyzer Channel Power.

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.



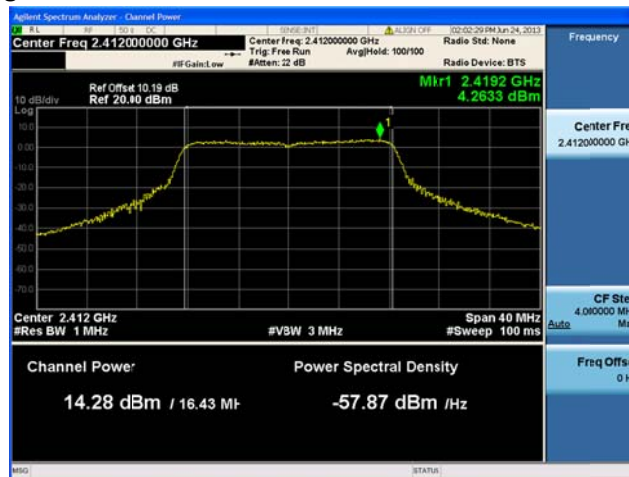
| Frequency (MHz) | Mode                    | Tx Paths | Correlated Antenna Gain (dBi) | Tx 1 Max Power (dBm) | Tx 2 Max Power (dBm) | Tx 3 Max Power (dBm) | Total Tx Channel Power (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|-------------------------|----------|-------------------------------|----------------------|----------------------|----------------------|------------------------------|-------------|-------------|
| 2412            | CCK, 1 to 11 Mbps       | 1        | 3                             | 23.3                 |                      |                      | 23.3                         | 30          | 6.7         |
|                 | CCK, 1 to 11 Mbps       | 2        | 3                             | 23.3                 | 21.7                 |                      | 25.6                         | 30          | 4.4         |
|                 | CCK, 1 to 11 Mbps       | 3        | 3                             | 22.2                 | 20.7                 | 22.7                 | 26.7                         | 30          | 3.3         |
|                 | Non HT-20, 6 to 54 Mbps | 1        | 3                             | 18.6                 |                      |                      | 18.6                         | 30          | 11.4        |
|                 | Non HT-20, 6 to 54 Mbps | 2        | 3                             | 16.0                 | 14.3                 |                      | 18.2                         | 30          | 11.8        |
|                 | Non HT-20, 6 to 54 Mbps | 3        | 3                             | 13.9                 | 12.8                 | 14.2                 | 18.4                         | 30          | 11.6        |
|                 | HT-20, M0 to M7         | 1        | 3                             | 16.8                 |                      |                      | 16.8                         | 30          | 13.2        |
|                 | HT-20, M0 to M7         | 2        | 3                             | 14.7                 | 13.3                 |                      | 17.1                         | 30          | 12.9        |
|                 | HT-20, M8 to M15        | 2        | 3                             | 14.7                 | 13.3                 |                      | 17.1                         | 30          | 12.9        |
|                 | HT-20, M0 to M7         | 3        | 3                             | 11.9                 | 10.3                 | 12.0                 | 16.2                         | 30          | 13.8        |
|                 | HT-20, M8 to M15        | 3        | 3                             | 11.9                 | 10.3                 | 12.0                 | 16.2                         | 30          | 13.8        |
|                 | HT-20, M16 to M23       | 3        | 3                             | 11.9                 | 10.3                 | 12.0                 | 16.2                         | 30          | 13.8        |
|                 | HT-20 STBC, M0 to M7    | 2        | 3                             | 14.7                 | 13.3                 |                      | 17.1                         | 30          | 12.9        |
|                 | HT-20 STBC, M0 to M7    | 3        | 3                             | 11.9                 | 10.3                 | 12.0                 | 16.2                         | 30          | 13.8        |
| 2437            | CCK, 1 to 11 Mbps       | 1        | 3                             | 23.7                 |                      |                      | 23.7                         | 30          | 6.3         |
|                 | CCK, 1 to 11 Mbps       | 2        | 3                             | 23.7                 | 23.8                 |                      | 26.8                         | 30          | 3.2         |
|                 | CCK, 1 to 11 Mbps       | 3        | 3                             | 23.7                 | 23.8                 | 23.9                 | 28.6                         | 30          | 1.4         |
|                 | Non HT-20, 6 to 54 Mbps | 1        | 3                             | 24.2                 |                      |                      | 24.2                         | 30          | 5.8         |
|                 | Non HT-20, 6 to 54 Mbps | 2        | 3                             | 23.1                 | 22.6                 |                      | 25.9                         | 30          | 4.1         |
|                 | Non HT-20, 6 to 54 Mbps | 3        | 3                             | 23.1                 | 22.6                 | 23.3                 | 27.8                         | 30          | 2.2         |
|                 | HT-20, M0 to M7         | 1        | 3                             | 24.0                 |                      |                      | 24.0                         | 30          | 6.0         |
|                 | HT-20, M0 to M7         | 2        | 3                             | 24.0                 | 23.2                 |                      | 26.6                         | 30          | 3.4         |
|                 | HT-20, M8 to M15        | 2        | 3                             | 24.0                 | 23.2                 |                      | 26.6                         | 30          | 3.4         |
|                 | HT-20, M0 to M7         | 3        | 3                             | 24.0                 | 23.2                 | 24.3                 | 28.6                         | 30          | 1.4         |
|                 | HT-20, M8 to M15        | 3        | 3                             | 24.0                 | 23.2                 | 24.3                 | 28.6                         | 30          | 1.4         |
|                 | HT-20, M16 to M23       | 3        | 3                             | 24.0                 | 23.2                 | 24.3                 | 28.6                         | 30          | 1.4         |
|                 | HT-20 STBC, M0 to M7    | 2        | 3                             | 24.0                 | 23.2                 |                      | 26.6                         | 30          | 3.4         |
|                 | HT-20 STBC, M0 to M7    | 3        | 3                             | 24.0                 | 23.2                 | 24.3                 | 28.6                         | 30          | 1.4         |
| 2462            | CCK, 1 to 11 Mbps       | 1        | 3                             | 22.8                 |                      |                      | 22.8                         | 30          | 7.2         |
|                 | CCK, 1 to 11 Mbps       | 2        | 3                             | 22.8                 | 23.7                 |                      | 26.3                         | 30          | 3.7         |
|                 | CCK, 1 to 11 Mbps       | 3        | 3                             | 21.8                 | 22.7                 | 22.2                 | 27.0                         | 30          | 3.0         |
|                 | Non HT-20, 6 to 54 Mbps | 1        | 3                             | 16.6                 |                      |                      | 16.6                         | 30          | 13.4        |
|                 | Non HT-20, 6 to 54 Mbps | 2        | 3                             | 15.6                 | 16.0                 |                      | 18.8                         | 30          | 11.2        |



|                         |   |   |      |      |      |      |    |      |
|-------------------------|---|---|------|------|------|------|----|------|
| Non HT-20, 6 to 54 Mbps | 3 | 3 | 13.6 | 14.3 | 14.2 | 18.8 | 30 | 11.2 |
| HT-20, M0 to M7         | 1 | 3 | 15.4 |      |      | 15.4 | 30 | 14.6 |
| HT-20, M0 to M7         | 2 | 3 | 13.3 | 14.1 |      | 16.7 | 30 | 13.3 |
| HT-20, M8 to M15        | 2 | 3 | 13.3 | 14.1 |      | 16.7 | 30 | 13.3 |
| HT-20, M0 to M7         | 3 | 3 | 11.6 | 12.0 | 12.1 | 16.7 | 30 | 13.3 |
| HT-20, M8 to M15        | 3 | 3 | 11.6 | 12.0 | 12.1 | 16.7 | 30 | 13.3 |
| HT-20, M16 to M23       | 3 | 3 | 11.6 | 12.0 | 12.1 | 16.7 | 30 | 13.3 |
| HT-20 STBC, M0 to M7    | 2 | 3 | 13.3 | 14.1 |      | 16.7 | 30 | 13.3 |
| HT-20 STBC, M0 to M7    | 3 | 3 | 11.6 | 12.0 | 12.1 | 16.7 | 30 | 13.3 |

**Peak Output Power, 2412 MHz, CCK, 1 to 11 Mbps****Antenna A****Peak Output Power, 2412 MHz, CCK, 1 to 11 Mbps****Antenna A****Antenna B**

**Peak Output Power, 2412 MHz, CCK, 1 to 11 Mbps****Antenna A****Antenna B****Antenna C**

**Peak Output Power, 2412 MHz, Non HT-20, 6 to 54 Mbps****Antenna A****Peak Output Power, 2412 MHz, Non HT-20, 6 to 54 Mbps****Antenna A****Antenna B**

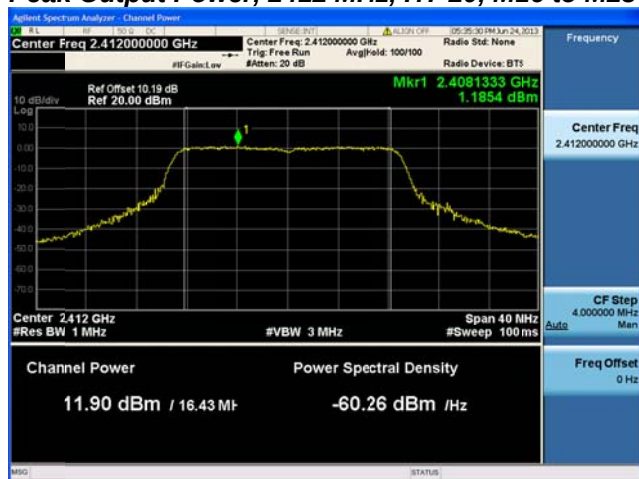
**Peak Output Power, 2412 MHz, Non HT-20, 6 to 54 Mbps****Antenna A****Antenna B****Antenna C**

**Peak Output Power, 2412 MHz, HT-20, M0 to M7****Antenna A****Peak Output Power, 2412 MHz, HT-20, M0 to M7****Antenna A****Antenna B**

**Peak Output Power, 2412 MHz, HT-20, M8 to M15****Antenna A****Antenna B**

**Peak Output Power, 2412 MHz, HT-20, M0 to M7****Antenna A****Antenna B****Antenna C**

**Peak Output Power, 2412 MHz, HT-20, M8 to M15****Antenna A****Antenna B****Antenna C**

**Peak Output Power, 2412 MHz, HT-20, M16 to M23****Antenna A****Antenna B****Antenna C**

**Peak Output Power, 2412 MHz, HT-20 STBC, M0 to M7****Antenna A****Antenna B**

**Peak Output Power, 2412 MHz, HT-20 STBC, M0 to M7****Antenna A****Antenna B****Antenna C**

**Peak Output Power, 2437 MHz, CCK, 1 to 11 Mbps****Antenna A****Peak Output Power, 2437 MHz, CCK, 1 to 11 Mbps****Antenna A****Antenna B**

**Peak Output Power, 2437 MHz, CCK, 1 to 11 Mbps****Antenna A****Antenna B****Antenna C**

**Peak Output Power, 2437 MHz, Non HT-20, 6 to 54 Mbps****Antenna A****Peak Output Power, 2437 MHz, Non HT-20, 6 to 54 Mbps****Antenna A****Antenna B**

**Peak Output Power, 2437 MHz, Non HT-20, 6 to 54 Mbps****Antenna A****Antenna B****Antenna C**

**Peak Output Power, 2437 MHz, HT-20, M0 to M7****Antenna A****Peak Output Power, 2437 MHz, HT-20, M0 to M7****Antenna A****Antenna B**

**Peak Output Power, 2437 MHz, HT-20, M8 to M15****Antenna A****Antenna B**

**Peak Output Power, 2437 MHz, HT-20, M0 to M7****Antenna A****Antenna B****Antenna C**

**Peak Output Power, 2437 MHz, HT-20, M8 to M15****Antenna A****Antenna B****Antenna C**

**Peak Output Power, 2437 MHz, HT-20, M16 to M23****Antenna A****Antenna B****Antenna C**

**Peak Output Power, 2437 MHz, HT-20 STBC, M0 to M7****Antenna A****Antenna B**

**Peak Output Power, 2437 MHz, HT-20 STBC, M0 to M7****Antenna A****Antenna B****Antenna C**

**Peak Output Power, 2462 MHz, CCK, 1 to 11 Mbps****Antenna A****Peak Output Power, 2462 MHz, CCK, 1 to 11 Mbps****Antenna A****Antenna B**

**Peak Output Power, 2462 MHz, CCK, 1 to 11 Mbps****Antenna A****Antenna B****Antenna C**

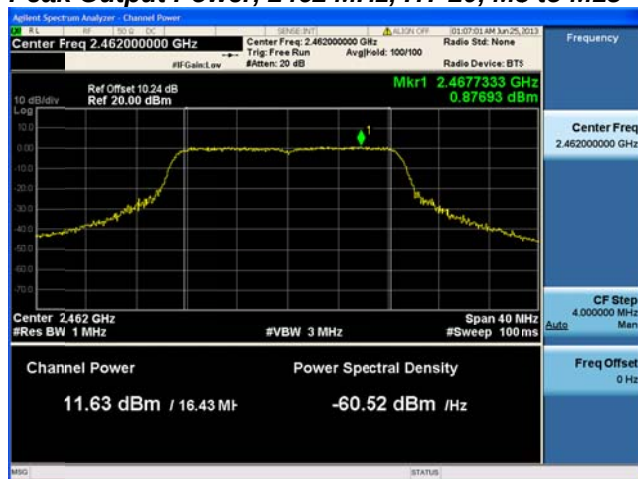
**Peak Output Power, 2462 MHz, Non HT-20, 6 to 54 Mbps****Antenna A****Peak Output Power, 2462 MHz, Non HT-20, 6 to 54 Mbps****Antenna A****Antenna B**

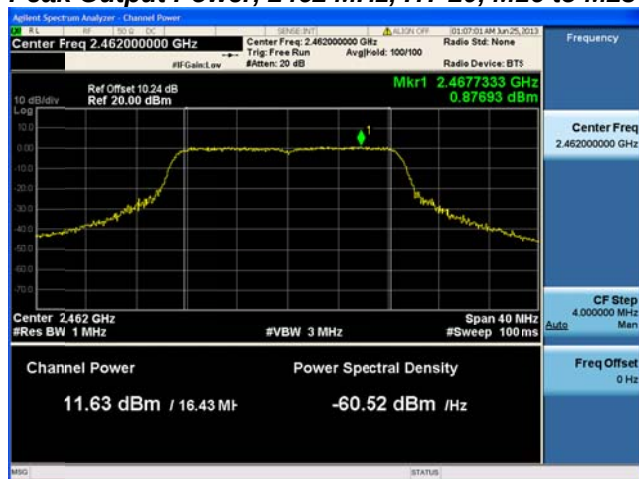
**Peak Output Power, 2462 MHz, Non HT-20, 6 to 54 Mbps****Antenna A****Antenna B****Antenna C**

**Peak Output Power, 2462 MHz, HT-20, M0 to M7****Antenna A****Peak Output Power, 2462 MHz, HT-20, M0 to M7****Antenna A****Antenna B**

**Peak Output Power, 2462 MHz, HT-20, M8 to M15****Antenna A****Antenna B**

**Peak Output Power, 2462 MHz, HT-20, M0 to M7****Antenna A****Antenna B****Antenna C**

**Peak Output Power, 2462 MHz, HT-20, M8 to M15****Antenna A****Antenna B****Antenna C**

**Peak Output Power, 2462 MHz, HT-20, M16 to M23****Antenna A****Antenna B****Antenna C**

**Peak Output Power, 2462 MHz, HT-20 STBC, M0 to M7****Antenna A****Antenna B**

**Peak Output Power, 2462 MHz, HT-20 STBC, M0 to M7****Antenna A****Antenna B****Antenna C**



## Power Spectral Density

15.247 / RSS-210 A8.2: For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

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

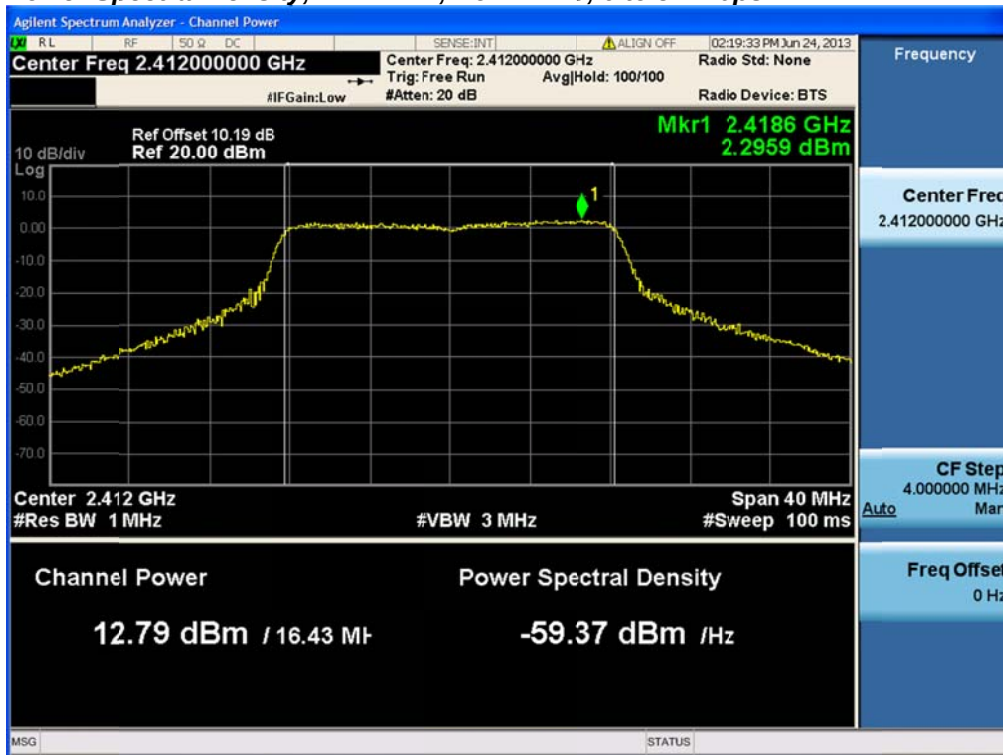
|                       |                                        |
|-----------------------|----------------------------------------|
| Center Frequency:     | Frequency from table below             |
| Span:                 | 20 MHz                                 |
| Ref Level Offset:     | Correct for attenuator and cable loss. |
| Reference Level:      | 20 dBm                                 |
| Attenuation:          | 20 dB                                  |
| Sweep Time:           | 10s                                    |
| Resolution Bandwidth: | 3 kHz                                  |
| Video Bandwidth:      | 10 kHz                                 |
| Detector:             | Peak                                   |
| Trace:                | Single                                 |
| Marker:               | Peak Search                            |

Record the Marker value.

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.



| Frequency (MHz) | Mode                    | Data Rate (Mbps) | PSD / Antenna (dBm/3kHz) | Total PSD (dBm/3kHz) | Limit (dBm/3kHz) | Margin (dB) |
|-----------------|-------------------------|------------------|--------------------------|----------------------|------------------|-------------|
| 2412            | CCK, 1 to 11 Mbps       | 11               | -0.5                     | 4.3                  | 8.0              | 3.7         |
|                 | Non HT-20, 6 to 54 Mbps | 6                | -14.3                    | -9.5                 | 8.0              | 17.5        |
|                 | HT-20, M0 to M23        | m0               | -13.7                    | -8.9                 | 8.0              | 16.9        |
| 2437            | CCK, 1 to 11 Mbps       | 11               | 2.5                      | 7.3                  | 8.0              | 0.7         |
|                 | Non HT-20, 6 to 54 Mbps | 6                | -4.6                     | 0.2                  | 8.0              | 7.8         |
|                 | HT-20, M0 to M23        | m0               | -3.8                     | 1.0                  | 8.0              | 7.0         |
| 2462            | CCK, 1 to 11 Mbps       | 11               | 0.6                      | 5.4                  | 8.0              | 2.6         |
|                 | Non HT-20, 6 to 54 Mbps | 6                | -13.6                    | -8.8                 | 8.0              | 16.8        |
|                 | HT-20, M0 to M23        | m0               | -13.8                    | -9.0                 | 8.0              | 17.0        |

**Power Spectral Density, 2412 MHz, CCK, 1 to 11 Mbps****Power Spectral Density, 2412 MHz, Non HT-20, 6 to 54 Mbps**

**Power Spectral Density, 2412 MHz, HT-20, M0 to M23****Power Spectral Density, 2437 MHz, CCK, 1 to 11 Mbps**

**Power Spectral Density, 2437 MHz, Non HT-20, 6 to 54 Mbps****Power Spectral Density, 2437 MHz, HT-20, M0 to M23**

**Power Spectral Density, 2462 MHz, CCK, 1 to 11 Mbps****Power Spectral Density, 2462 MHz, Non HT-20, 6 to 54 Mbps**

**Power Spectral Density, 2462 MHz, HT-20, M0 to M23**



## Conducted Spurious Emissions

15.247 / RSS-210 A8.5: In any 100 kHz bandwidth outside the frequency band in which the digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

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-26 GHz |
| Reference Level:      | 20 dBm        |
| Attenuation:          | 10 dB         |
| Sweep Time:           | 5s            |
| Resolution Bandwidth: | 100 kHz       |
| Video Bandwidth:      | 300 kHz       |
| Detector:             | Peak          |
| Trace:                | Single        |
| Marker:               | Peak          |

Record the marker waveform peak to spur difference

Out-of-band and spurious emissions tests are performed on each output individually without summing or adding  $10 \log(N)$  since the measurements are made relative to the in-band emissions on the individual outputs. The worst case output is recorded.



| Frequency (MHz) | Mode                    | Tx Paths | Correlated Antenna Gain (dBi) | Tx 1 Spur Power (dBm) | Tx 2 Spur Power (dBm) | Tx 3 Spur Power (dBm) | Total Conducted Spur (dBm) | Limit (dB) | Margin (dB) |
|-----------------|-------------------------|----------|-------------------------------|-----------------------|-----------------------|-----------------------|----------------------------|------------|-------------|
| 2412            | CCK, 1 to 11 Mbps       | 1        | 3                             | <a href="#">-58.2</a> |                       |                       | -55.2                      | -41.25     | 14.0        |
|                 | CCK, 1 to 11 Mbps       | 2        | 3                             | <a href="#">-58.2</a> | <a href="#">-58.2</a> |                       | -52.2                      | -41.25     | 10.9        |
|                 | CCK, 1 to 11 Mbps       | 3        | 3                             | <a href="#">-58.8</a> | <a href="#">-57.5</a> | <a href="#">-55.6</a> | -49.3                      | -41.25     | 8.1         |
|                 | Non HT-20, 6 to 54 Mbps | 1        | 3                             | <a href="#">-59.8</a> |                       |                       | -56.8                      | -41.25     | 15.6        |
|                 | Non HT-20, 6 to 54 Mbps | 2        | 3                             | <a href="#">-59.7</a> | <a href="#">-59.7</a> |                       | -53.7                      | -41.25     | 12.4        |
|                 | Non HT-20, 6 to 54 Mbps | 3        | 3                             | <a href="#">-59.8</a> | <a href="#">-59.8</a> | <a href="#">-59.6</a> | -52.0                      | -41.25     | 10.7        |
|                 | HT-20, M0 to M7         | 1        | 3                             | <a href="#">-59.7</a> |                       |                       | -56.7                      | -41.25     | 15.5        |
|                 | HT-20, M0 to M7         | 2        | 3                             | <a href="#">-59.7</a> | <a href="#">-59.9</a> |                       | -53.8                      | -41.25     | 12.5        |
|                 | HT-20, M8 to M15        | 2        | 3                             | <a href="#">-59.7</a> | <a href="#">-59.9</a> |                       | -53.8                      | -41.25     | 12.5        |
|                 | HT-20, M0 to M7         | 3        | 3                             | <a href="#">-59.9</a> | <a href="#">-59.7</a> | <a href="#">-59.7</a> | -52.0                      | -41.25     | 10.7        |
|                 | HT-20, M8 to M15        | 3        | 3                             | <a href="#">-59.9</a> | <a href="#">-59.7</a> | <a href="#">-59.7</a> | -52.0                      | -41.25     | 10.7        |
|                 | HT-20, M16 to M23       | 3        | 3                             | <a href="#">-59.9</a> | <a href="#">-59.7</a> | <a href="#">-59.7</a> | -52.0                      | -41.25     | 10.7        |
|                 | HT-20 STBC, M0 to M7    | 2        | 3                             | <a href="#">-59.7</a> | <a href="#">-59.9</a> |                       | -53.8                      | -41.25     | 12.5        |
|                 | HT-20 STBC, M0 to M7    | 3        | 3                             | <a href="#">-59.9</a> | <a href="#">-59.7</a> | <a href="#">-59.7</a> | -52.0                      | -41.25     | 10.7        |

|      |                         |   |   |                       |                       |                       |       |        |      |
|------|-------------------------|---|---|-----------------------|-----------------------|-----------------------|-------|--------|------|
| 2437 | CCK, 1 to 11 Mbps       | 1 | 3 | <a href="#">-59.5</a> |                       |                       | -56.5 | -41.25 | 15.3 |
|      | CCK, 1 to 11 Mbps       | 2 | 3 | <a href="#">-59.5</a> | <a href="#">-58.7</a> |                       | -53.1 | -41.25 | 11.8 |
|      | CCK, 1 to 11 Mbps       | 3 | 3 | <a href="#">-59.5</a> | <a href="#">-58.7</a> | <a href="#">-57.9</a> | -50.9 | -41.25 | 9.6  |
|      | Non HT-20, 6 to 54 Mbps | 1 | 3 | <a href="#">-59.2</a> |                       |                       | -56.2 | -41.25 | 15.0 |
|      | Non HT-20, 6 to 54 Mbps | 2 | 3 | <a href="#">-59.4</a> | <a href="#">-59.2</a> |                       | -53.3 | -41.25 | 12.0 |
|      | Non HT-20, 6 to 54 Mbps | 3 | 3 | <a href="#">-59.4</a> | <a href="#">-59.2</a> | <a href="#">-59.1</a> | -51.5 | -41.25 | 10.2 |
|      | HT-20, M0 to M7         | 1 | 3 | <a href="#">-59.3</a> |                       |                       | -56.3 | -41.25 | 15.1 |
|      | HT-20, M0 to M7         | 2 | 3 | <a href="#">-59.3</a> | <a href="#">-59.4</a> |                       | -53.3 | -41.25 | 12.1 |
|      | HT-20, M8 to M15        | 2 | 3 | <a href="#">-59.3</a> | <a href="#">-59.4</a> |                       | -53.3 | -41.25 | 12.1 |
|      | HT-20, M0 to M7         | 3 | 3 | <a href="#">-59.3</a> | <a href="#">-59.4</a> | <a href="#">-58.9</a> | -51.4 | -41.25 | 10.2 |
|      | HT-20, M8 to M15        | 3 | 3 | <a href="#">-59.3</a> | <a href="#">-59.4</a> | <a href="#">-58.9</a> | -51.4 | -41.25 | 10.2 |
|      | HT-20, M16 to M23       | 3 | 3 | <a href="#">-59.3</a> | <a href="#">-59.4</a> | <a href="#">-58.9</a> | -51.4 | -41.25 | 10.2 |
|      | HT-20 STBC, M0 to M7    | 2 | 3 | <a href="#">-59.3</a> | <a href="#">-59.4</a> |                       | -53.3 | -41.25 | 12.1 |
|      | HT-20 STBC, M0 to M7    | 3 | 3 | <a href="#">-59.3</a> | <a href="#">-59.4</a> | <a href="#">-58.9</a> | -51.4 | -41.25 | 10.2 |

|      |                         |   |   |                       |                       |                       |       |        |      |
|------|-------------------------|---|---|-----------------------|-----------------------|-----------------------|-------|--------|------|
| 2462 | CCK, 1 to 11 Mbps       | 1 | 3 | <a href="#">-59.4</a> |                       |                       | -56.4 | -41.25 | 15.2 |
|      | CCK, 1 to 11 Mbps       | 2 | 3 | <a href="#">-59.4</a> | <a href="#">-59.4</a> |                       | -53.4 | -41.25 | 12.1 |
|      | CCK, 1 to 11 Mbps       | 3 | 3 | <a href="#">-59.3</a> | <a href="#">-59.3</a> | <a href="#">-59.6</a> | -51.6 | -41.25 | 10.4 |
|      | Non HT-20, 6 to 54 Mbps | 1 | 3 | <a href="#">-59.7</a> |                       |                       | -56.7 | -41.25 | 15.5 |
|      | Non HT-20, 6 to 54 Mbps | 2 | 3 | <a href="#">-59.6</a> | <a href="#">-59.4</a> |                       | -53.5 | -41.25 | 12.2 |



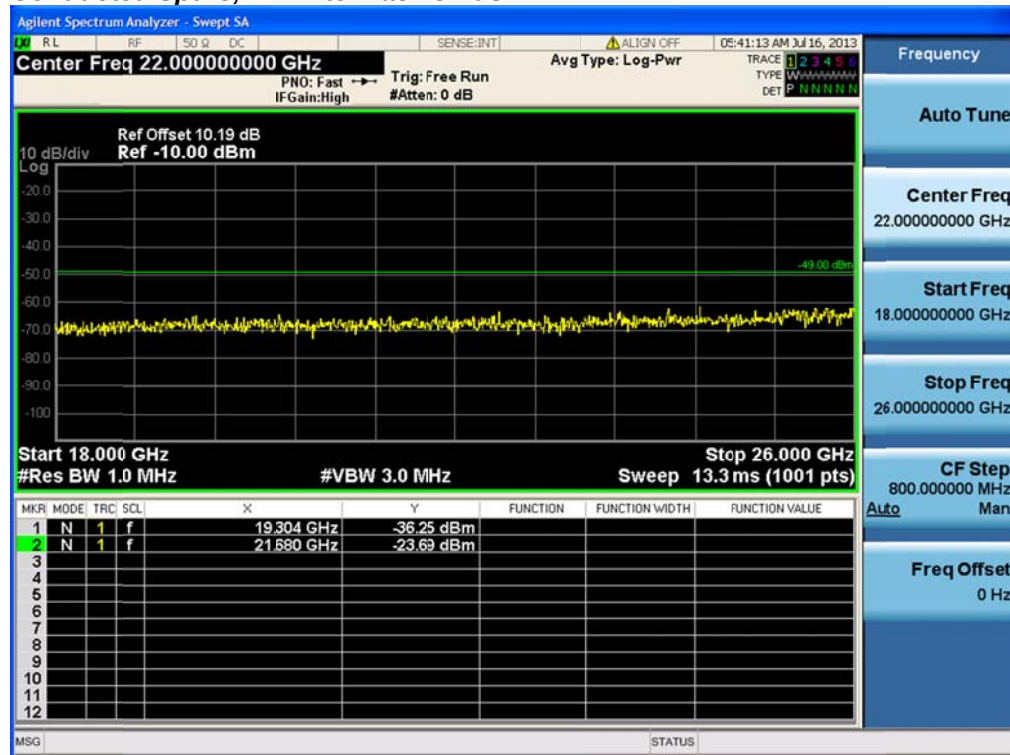
|  |                         |   |   |              |              |              |       |        |      |
|--|-------------------------|---|---|--------------|--------------|--------------|-------|--------|------|
|  | Non HT-20, 6 to 54 Mbps | 3 | 3 | <u>-59.6</u> | <u>-59.7</u> | <u>-59.4</u> | -51.8 | -41.25 | 10.5 |
|  | HT-20, M0 to M7         | 1 | 3 | <u>-59.5</u> |              |              | -56.5 | -41.25 | 15.3 |
|  | HT-20, M0 to M7         | 2 | 3 | <u>-59.6</u> | <u>-59.5</u> |              | -53.5 | -41.25 | 12.3 |
|  | HT-20, M8 to M15        | 2 | 3 | <u>-59.6</u> | <u>-59.5</u> |              | -53.5 | -41.25 | 12.3 |
|  | HT-20, M0 to M7         | 3 | 3 | <u>-59.6</u> | <u>-59.6</u> | <u>-59.4</u> | -51.8 | -41.25 | 10.5 |
|  | HT-20, M8 to M15        | 3 | 3 | <u>-59.6</u> | <u>-59.6</u> | <u>-59.4</u> | -51.8 | -41.25 | 10.5 |
|  | HT-20, M16 to M23       | 3 | 3 | <u>-59.6</u> | <u>-59.6</u> | <u>-59.4</u> | -51.8 | -41.25 | 10.5 |
|  | HT-20 STBC, M0 to M7    | 2 | 3 | <u>-59.6</u> | <u>-59.5</u> |              | -53.5 | -41.25 | 12.3 |
|  | HT-20 STBC, M0 to M7    | 3 | 3 | <u>-59.6</u> | <u>-59.6</u> | <u>-59.4</u> | -51.8 | -41.25 | 10.5 |



| Frequency (MHz) | Mode                    | Tx Paths | Correlated Antenna Gain (dBi) | Tx 1 Spur Power (dBm) | Tx 2 Spur Power (dBm) | Tx 3 Spur Power (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|-------------------------|----------|-------------------------------|-----------------------|-----------------------|-----------------------|-------------|-------------|
| 2412            | CCK, 1 to 11 Mbps       | 1        | 3                             | -51.4                 |                       |                       | -51.4       | -27         |
|                 | CCK, 1 to 11 Mbps       | 2        | 3                             | -51.4                 | -49.4                 |                       | -47.3       | -27         |
|                 | CCK, 1 to 11 Mbps       | 3        | 3                             | -51.9                 | -52.0                 | -51.0                 | -46.8       | -27         |
|                 | Non HT-20, 6 to 54 Mbps | 1        | 3                             | -50.1                 |                       |                       | -50.1       | -27         |
|                 | Non HT-20, 6 to 54 Mbps | 2        | 3                             | -51.0                 | -51.9                 |                       | -48.4       | -27         |
|                 | Non HT-20, 6 to 54 Mbps | 3        | 3                             | -52.8                 | -50.1                 | -50.2                 | -46.1       | -27         |
|                 | HT-20, M0 to M7         | 1        | 3                             | -51.6                 |                       |                       | -51.6       | -27         |
|                 | HT-20, M0 to M7         | 2        | 3                             | -51.0                 | -50.6                 |                       | -47.8       | -27         |
|                 | HT-20, M8 to M15        | 2        | 3                             | -51.0                 | -50.6                 |                       | -47.8       | -27         |
|                 | HT-20, M0 to M7         | 3        | 3                             | -50.7                 | -50.3                 | -50.0                 | -45.6       | -27         |
|                 | HT-20, M8 to M15        | 3        | 3                             | -50.7                 | -50.3                 | -50.0                 | -45.6       | -27         |
|                 | HT-20, M16 to M23       | 3        | 3                             | -50.7                 | -50.3                 | -50.0                 | -45.6       | -27         |
|                 | HT-20 STBC, M0 to M7    | 2        | 3                             | -51.0                 | -50.6                 |                       | -47.8       | -27         |
|                 | HT-20 STBC, M0 to M7    | 3        | 3                             | -50.7                 | -50.3                 | -50.0                 | -45.6       | -27         |
| 2437            | CCK, 1 to 11 Mbps       | 1        | 3                             | -53.1                 |                       |                       | -53.1       | -27         |
|                 | CCK, 1 to 11 Mbps       | 2        | 3                             | -53.1                 | -51.1                 |                       | -49.0       | -27         |
|                 | CCK, 1 to 11 Mbps       | 3        | 3                             | -53.1                 | -51.1                 | -51.2                 | -46.9       | -27         |
|                 | Non HT-20, 6 to 54 Mbps | 1        | 3                             | -50.8                 |                       |                       | -50.8       | -27         |
|                 | Non HT-20, 6 to 54 Mbps | 2        | 3                             | -51.5                 | -50.9                 |                       | -48.2       | -27         |
|                 | Non HT-20, 6 to 54 Mbps | 3        | 3                             | -51.5                 | -50.9                 | -48.8                 | -45.5       | -27         |
|                 | HT-20, M0 to M7         | 1        | 3                             | -50.5                 |                       |                       | -50.5       | -27         |
|                 | HT-20, M0 to M7         | 2        | 3                             | -50.5                 | -51.4                 |                       | -47.9       | -27         |
|                 | HT-20, M8 to M15        | 2        | 3                             | -50.5                 | -51.4                 |                       | -47.9       | -27         |
|                 | HT-20, M0 to M7         | 3        | 3                             | -50.5                 | -51.4                 | -51.9                 | -46.5       | -27         |
|                 | HT-20, M8 to M15        | 3        | 3                             | -50.5                 | -51.4                 | -51.9                 | -46.5       | -27         |
|                 | HT-20, M16 to M23       | 3        | 3                             | -50.5                 | -51.4                 | -51.9                 | -46.5       | -27         |
|                 | HT-20 STBC, M0 to M7    | 2        | 3                             | -50.5                 | -51.4                 |                       | -47.9       | -27         |
|                 | HT-20 STBC, M0 to M7    | 3        | 3                             | -50.5                 | -51.4                 | -51.9                 | -46.5       | -27         |
| 2462            | CCK, 1 to 11 Mbps       | 1        | 3                             | -49.8                 |                       |                       | -49.8       | -27         |
|                 | CCK, 1 to 11 Mbps       | 2        | 3                             | -49.8                 | -51.3                 |                       | -47.5       | -27         |
|                 | CCK, 1 to 11 Mbps       | 3        | 3                             | -53.1                 | -49.5                 | -51.7                 | -46.4       | -27         |
|                 | Non HT-20, 6 to 54 Mbps | 1        | 3                             | -50.1                 |                       |                       | -50.1       | -27         |
|                 | Non HT-20, 6 to 54 Mbps | 2        | 3                             | -50.0                 | -51.1                 |                       | -47.5       | -27         |



|                         |   |   |       |       |       |       |     |
|-------------------------|---|---|-------|-------|-------|-------|-----|
| Non HT-20, 6 to 54 Mbps | 3 | 3 | -50.3 | -49.8 | -52.1 | -45.9 | -27 |
| HT-20, M0 to M7         | 1 | 3 | -50.6 |       |       | -50.6 | -27 |
| HT-20, M0 to M7         | 2 | 3 | -53.1 | -51.4 |       | -49.2 | -27 |
| HT-20, M8 to M15        | 2 | 3 | -53.1 | -51.4 |       | -49.2 | -27 |
| HT-20, M0 to M7         | 3 | 3 | -50.4 | -51.1 | -51.9 | -46.3 | -27 |
| HT-20, M8 to M15        | 3 | 3 | -50.4 | -51.1 | -51.9 | -46.3 | -27 |
| HT-20, M16 to M23       | 3 | 3 | -50.4 | -51.1 | -51.9 | -46.3 | -27 |
| HT-20 STBC, M0 to M7    | 2 | 3 | -53.1 | -51.4 |       | -49.2 | -27 |
| HT-20 STBC, M0 to M7    | 3 | 3 | -50.4 | -51.1 | -51.9 | -46.3 | -27 |

**Conducted Spurs, All Antennas 18-26GHz**

**Conducted Spurs Average, 2412 MHz, CCK, 1 to 11 Mbps****Antenna A****Conducted Spurs Average, 2412 MHz, CCK, 1 to 11 Mbps****Antenna A****Antenna B**

**Conducted Spurs Average, 2412 MHz, CCK, 1 to 11 Mbps****Antenna A****Antenna B****Antenna C**

**Conducted Spurs Average, 2412 MHz, Non HT-20, 6 to 54 Mbps****Antenna A****Conducted Spurs Average, 2412 MHz, Non HT-20, 6 to 54 Mbps****Antenna A****Antenna B**

**Conducted Spurs Average, 2412 MHz, Non HT-20, 6 to 54 Mbps****Antenna A****Antenna B****Antenna C**

**Conducted Spurs Average, 2412 MHz, HT-20, M0 to M7****Antenna A****Conducted Spurs Average, 2412 MHz, HT-20, M0 to M7****Antenna A****Antenna B**

**Conducted Spurs Average, 2412 MHz, HT-20, M8 to M15****Antenna A****Antenna B**

**Conducted Spurs Average, 2412 MHz, HT-20, M0 to M7****Antenna A****Antenna B****Antenna C**

**Conducted Spurs Average, 2412 MHz, HT-20, M8 to M15****Antenna A****Antenna B****Antenna C**

**Conducted Spurs Average, 2412 MHz, HT-20, M16 to M23****Antenna A****Antenna B****Antenna C**

**Conducted Spurs Average, 2412 MHz, HT-20 STBC, M0 to M7****Antenna A****Antenna B**