



## Test Report

# AIR-CAP3602y-A-K9

## Cisco Aironet 802.11n Dual Band Access Points

FCC ID: LDK102075

IC: 2461B-102075

(Also covers AIR-CAP3602y-N-K9, AIR-CAP3602y-T-K9)

y = E (External Antenna) or I (Internal Antenna)

**5725-5850 MHz**

Against the following Specifications:

CFR47 Part 15.247

RSS210

**Cisco Systems**

170 West Tasman Drive

San Jose, CA 95134



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## 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 15.247<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**

04-April-2011 – 04-May-2011

**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

**2.5 Equipment Assessed (EUT)**

AIR-CAP3602E-A-K9 Cisco Aironet 802.11n Dual Band Access Point



## 2.6 EUT Description

The 3600 Series Cisco Aironet 802.11n Dual Band 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.

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  
Non HT-20, Four Antennas, 6 to 54 Mbps

Non HT-20 Beam Forming, Two Antennas, 6 to 54 Mbps  
Non HT-20 Beam Forming, Three Antennas, 6 to 54 Mbps  
Non HT-20 Beam Forming, Four 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, Four Antennas, M0 to M23

HT-20 STBC, Two Antennas, M0 to M7  
HT-20 STBC, Three Antennas, M0 to M7  
HT-20 STBC, Four Antennas, M0 to M7

HT-20 Beam Forming, Two Antennas, M0 to M15  
HT-20 Beam Forming, Three Antennas, M0 to M23  
HT-20 Beam Forming, Four Antennas, M0 to M23

Non HT-40 Duplicate, One Antenna, 6-54 Mbps  
Non HT-40 Duplicate, Two Antennas, 6-54 Mbps  
Non HT-40 Duplicate, Three Antennas, 6-54 Mbps  
Non HT-40 Duplicate, Four Antennas, 6-54 Mbps

HT-40, One Antenna, M0 to M7  
HT-40, Two Antennas, M0 to M15  
HT-40, Three Antennas, M0 to M23  
HT-40, Four Antennas, M0 to M23

HT-40 STBC, Two Antennas, M0 to M7  
HT-40 STBC, Three Antennas, M0 to M7  
HT-40 STBC, Four Antennas, M0 to M7

HT-40 Beam Forming, Two Antennas, M0 to M15  
HT-40 Beam Forming, Three Antennas, M0 to M23  
HT-40 Beam Forming, Four Antennas, M0 to M23



The following antennas are supported by this product series. The items in bold will be specifically tested and cover all others. 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> | AIR-ANT2524DB-R  | Dual-resonant black dipole                   | 2 / 4              |
|                  | AIR-ANT2524DW-R  | Dual-resonant white dipole                   | 2 / 4              |
|                  | AIR-ANT2524DG-R  | Dual-resonant gray dipole                    | 2 / 4              |
|                  | Internal         | Dual-resonant Omni                           | 3 / 5              |
|                  | AIR-ANT2534V4C-R | Dual-resonant ceiling mount omni (4-pack)    | 3 / 4              |
|                  | AIR-ANT2546V4M-R | Dual-resonant omni (4-pack)                  | 4 / 6              |
|                  | AIR-ANT2566P4W-R | Dual-resonant "directional" antenna (4-pack) | 6 / 6              |



#### 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-CAP3602E-A-K9 |             | Cisco Systems | NA            | NA            | NA            |               |
| S02        | AIR-PWR-B         | 341-0306-01 | Cisco Systems | NA            | NA            | NA            |               |
| S03        | AIR-ANT2455V-N    |             |               |               |               |               |               |
| S04        | AIR-ANT5160V-R    |             |               |               |               |               |               |
| S05        | AIR-ANT2566P4W-R  |             |               |               |               |               |               |

##### 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 |





## 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)             |      |           |
|                                      | 5745                        | 5785 | 5825      |
| Non HT-20, 6 to 54 Mbps              | 23                          | 23   | 23        |
| Non HT-20 Beam Forming, 6 to 54 Mbps | 23                          | 23   | 23        |
| HT-20, M0 to M23                     | 23                          | 23   | 23        |
| HT-20 STBC, M0 to M7                 | 23                          | 23   | 23        |
| HT-20 Beam Forming, M0 to M23        | 23                          | 23   | 23        |
|                                      | 5745/5765                   |      | 5785/5805 |
| Non HT-40 Duplicate, 6-54 Mbps       | 23                          |      | 23        |
| HT-40, M0 to M23                     | 23                          |      | 23        |
| HT-40 STBC, M0 to M7                 | 23                          |      | 23        |
| HT-40 Beam Forming, M0 to M23        | 23                          |      | 23        |



## 6dB Bandwidth

15.247: 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   |

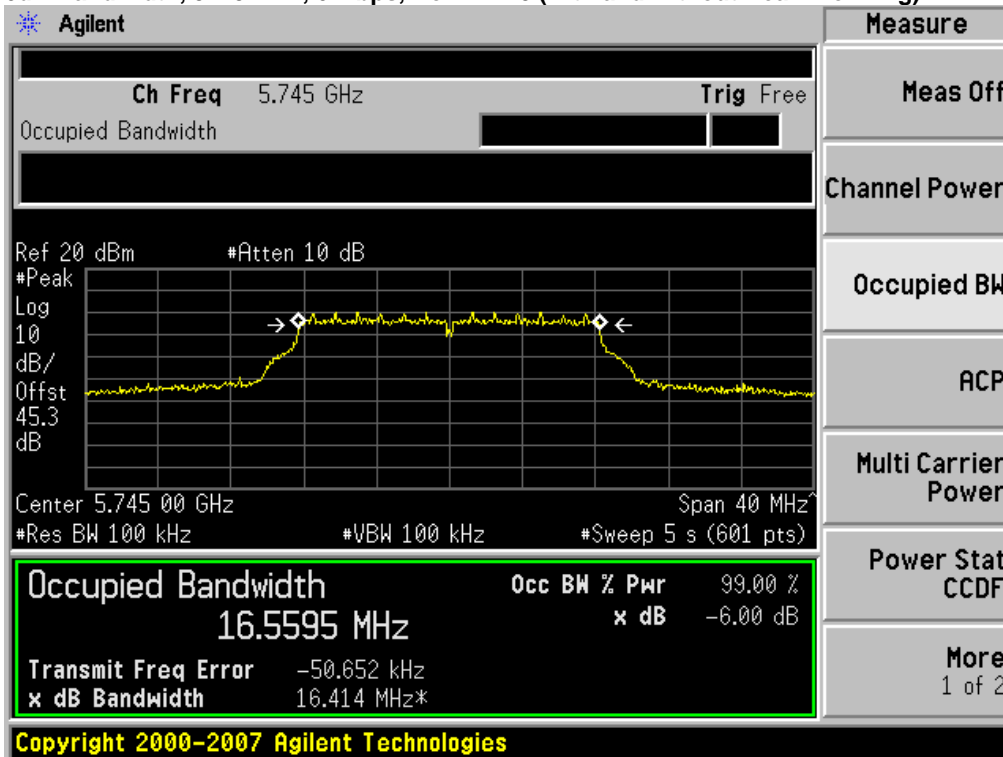
Place the radio in continuous transmit mode. View the transmitter waveform on the spectrum analyzer, and record the pertinent measurements:



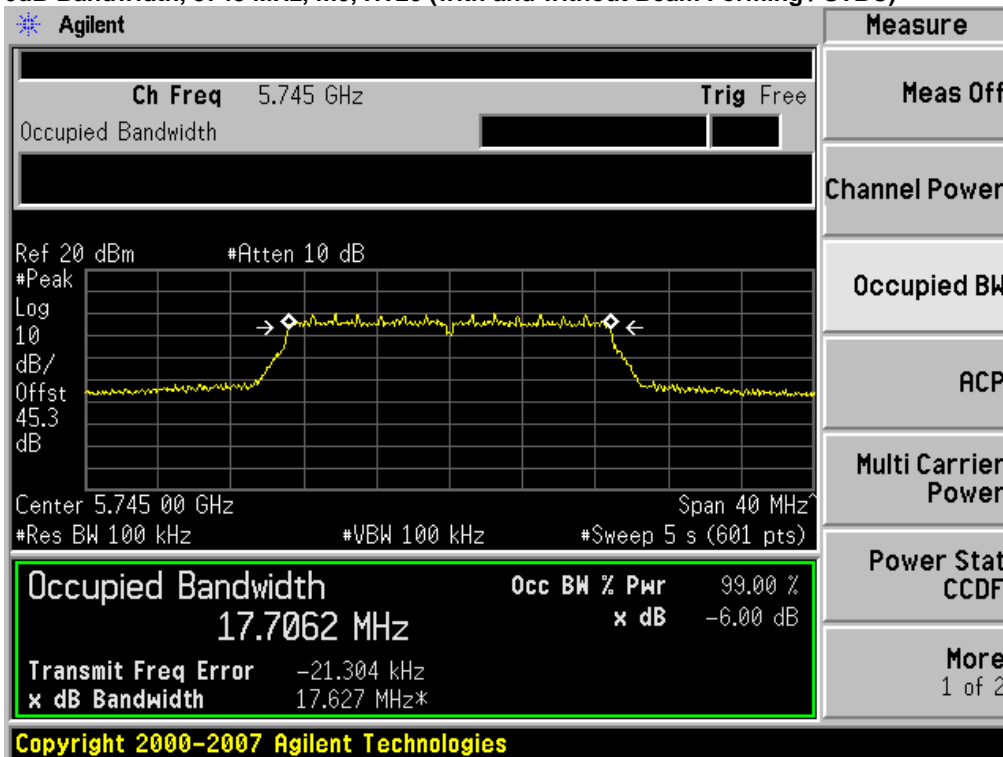
| Frequency (MHz) | Mode                                 | Data Rate (Mbps) | 6dB BW (MHz) | Limit (kHz) | Margin (MHz) |
|-----------------|--------------------------------------|------------------|--------------|-------------|--------------|
| 5745            | Non HT-20, 6 to 54 Mbps              | 6                | 16.4         | >500        | 15.9         |
|                 | Non HT-20 Beam Forming, 6 to 54 Mbps | 6                | 16.4         | >500        | 15.9         |
|                 | HT-20, M0 to M23                     | m0               | 17.6         | >500        | 17.1         |
|                 | HT-20 STBC, M0 to M7                 | m0               | 17.6         | >500        | 17.1         |
|                 | HT-20 Beam Forming, M0 to M23        | m0               | 17.6         | >500        | 17.1         |
| 5785            | Non HT-20, 6 to 54 Mbps              | 6                | 16.4         | >500        | 15.9         |
|                 | Non HT-20 Beam Forming, 6 to 54 Mbps | 6                | 16.4         | >500        | 15.9         |
|                 | HT-20, M0 to M23                     | m0               | 17.6         | >500        | 17.1         |
|                 | HT-20 STBC, M0 to M7                 | m0               | 17.6         | >500        | 17.1         |
|                 | HT-20 Beam Forming, M0 to M23        | m0               | 17.6         | >500        | 17.1         |
| 5825            | Non HT-20, 6 to 54 Mbps              | 6                | 16.4         | >500        | 15.9         |
|                 | Non HT-20 Beam Forming, 6 to 54 Mbps | 6                | 16.4         | >500        | 15.9         |
|                 | HT-20, M0 to M23                     | m0               | 17.6         | >500        | 17.1         |
|                 | HT-20 STBC, M0 to M7                 | m0               | 17.6         | >500        | 17.1         |
|                 | HT-20 Beam Forming, M0 to M23        | m0               | 17.6         | >500        | 17.1         |
| 5745/5765       | Non HT-40 Duplicate, 6-54 Mbps       | 6                | 36.4         | >500        | 35.9         |
|                 | HT-40, M0 to M23                     | m0               | 36.5         | >500        | 36.0         |
|                 | HT-40 STBC, M0 to M7                 | m0               | 36.5         | >500        | 36.0         |
|                 | HT-40 Beam Forming, M0 to M23        | m0               | 36.5         | >500        | 36.0         |
| 5785/5805       | Non HT-40 Duplicate, 6-54 Mbps       | 6                | 36.4         | >500        | 35.9         |
|                 | HT-40, M0 to M23                     | m0               | 36.4         | >500        | 35.9         |
|                 | HT-40 STBC, M0 to M7                 | m0               | 36.4         | >500        | 35.9         |
|                 | HT-40 Beam Forming, M0 to M23        | m0               | 36.4         | >500        | 35.9         |



6dB Bandwidth, 5745 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)



6dB Bandwidth, 5745 MHz, m0, HT20 (with and without Beam Forming / STBC)





6dB Bandwidth, 5785 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)

**Agilent**

Ch Freq 5.785 GHz Trig Free

Occupied Bandwidth

Ref 20 dBm #Atten 10 dB

#Peak

Log

10

dB/

Offst

45.3

dB

Center 5.785 00 GHz Span 40 MHz

#Res BW 100 kHz #VBW 100 kHz #Sweep 5 s (601 pts)

|                            |                     |             |
|----------------------------|---------------------|-------------|
| <b>Occupied Bandwidth</b>  | <b>Occ BW % Pwr</b> | 99.00 %     |
| 16.5658 MHz                | x dB                | -6.00 dB    |
| <b>Transmit Freq Error</b> |                     | -42.251 kHz |
| <b>x dB Bandwidth</b>      |                     | 16.413 MHz* |

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**Measure**

Meas Off

Channel Power

Occupied BW

ACP

Multi Carrier Power

Power Stat CCDF

More  
1 of 2

6dB Bandwidth, 5785 MHz, m0, HT20 (with and without Beam Forming / STBC)

**Agilent**

Ch Freq 5.785 GHz Trig Free

Occupied Bandwidth

Ref 20 dBm #Atten 10 dB

#Peak

Log

10

dB/

Offst

45.3

dB

Center 5.785 00 GHz Span 40 MHz

#Res BW 100 kHz #VBW 100 kHz #Sweep 5 s (601 pts)

|                            |                     |             |
|----------------------------|---------------------|-------------|
| <b>Occupied Bandwidth</b>  | <b>Occ BW % Pwr</b> | 99.00 %     |
| 17.7200 MHz                | x dB                | -6.00 dB    |
| <b>Transmit Freq Error</b> |                     | -21.528 kHz |
| <b>x dB Bandwidth</b>      |                     | 17.640 MHz* |

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**Measure**

Meas Off

Channel Power

Occupied BW

ACP

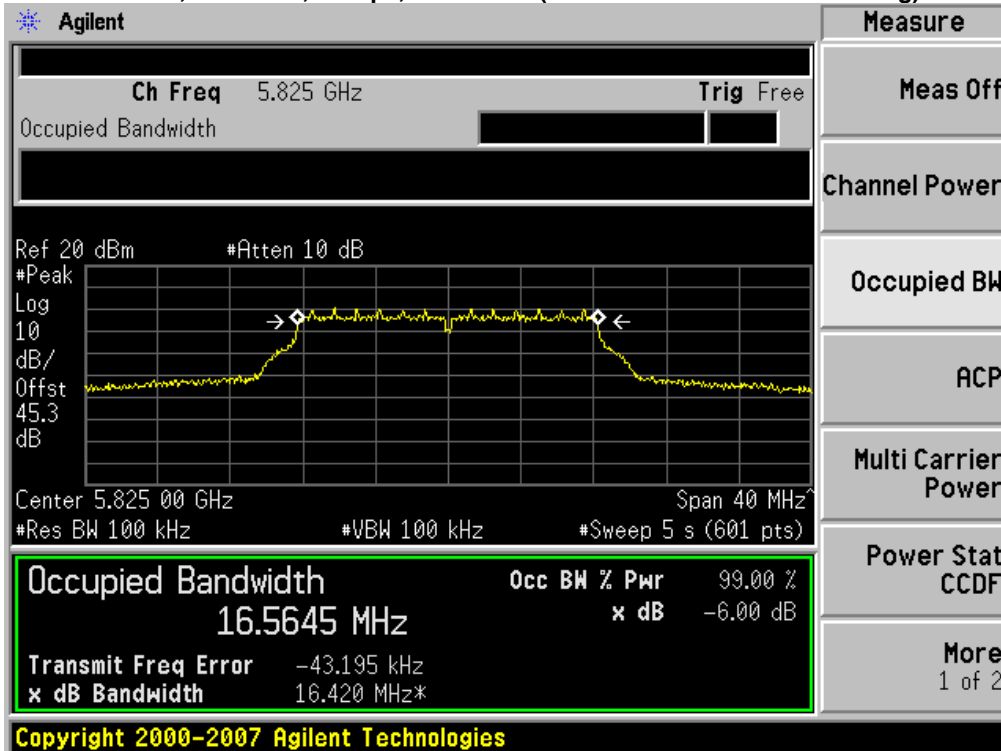
Multi Carrier Power

Power Stat CCDF

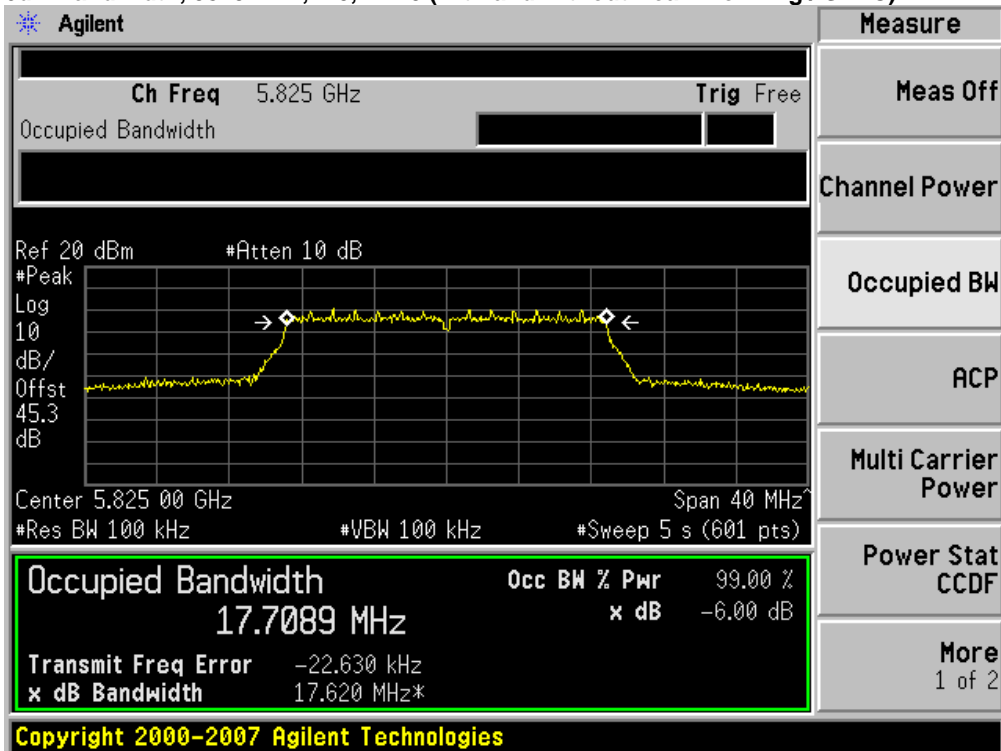
More  
1 of 2



6dB Bandwidth, 5825 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)



6dB Bandwidth, 5825 MHz, m0, HT20 (with and without Beam Forming / STBC)





6dB Bandwidth, 5745/5765 MHz, 6 Mbps, Non HT-40 Duplicate

Agilent

Ch Freq 5.755 GHz Trig Free

Occupied Bandwidth

Ref 20 dBm #Atten 10 dB

#Peak

Log

10

dB/

Offst

45.3

dB

Center 5.755 00 GHz Span 80 MHz

#Res BW 100 kHz #VBW 100 kHz #Sweep 5 s (601 pts)

|                            |                     |             |
|----------------------------|---------------------|-------------|
| <b>Occupied Bandwidth</b>  | <b>Occ BW % Pwr</b> | 99.00 %     |
| 36.4383 MHz                | x dB                | -6.00 dB    |
| <b>Transmit Freq Error</b> |                     | -65.806 kHz |
| <b>x dB Bandwidth</b>      |                     | 36.394 MHz* |

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Measure

Meas Off

Channel Power

Occupied BW

ACP

Multi Carrier Power

Power Stat CCDF

More 1 of 2

6dB Bandwidth, 5745/5765 MHz, m0, HT-40 (with and without Beam Forming / STBC)

Agilent

Ch Freq 5.755 GHz Trig Free

Occupied Bandwidth

Ref 20 dBm #Atten 10 dB

#Peak

Log

10

dB/

Offst

45.3

dB

Center 5.755 00 GHz Span 80 MHz

#Res BW 100 kHz #VBW 100 kHz #Sweep 5 s (601 pts)

|                            |                     |             |
|----------------------------|---------------------|-------------|
| <b>Occupied Bandwidth</b>  | <b>Occ BW % Pwr</b> | 99.00 %     |
| 36.8304 MHz                | x dB                | -6.00 dB    |
| <b>Transmit Freq Error</b> |                     | -20.649 kHz |
| <b>x dB Bandwidth</b>      |                     | 36.469 MHz* |

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Measure

Meas Off

Channel Power

Occupied BW

ACP

Multi Carrier Power

Power Stat CCDF

More 1 of 2



6dB Bandwidth, 5785/5805 MHz, 6 Mbps, Non HT-40 Duplicate

**Agilent**

Ch Freq 5.795 GHz Trig Free

Occupied Bandwidth

Ref 20 dBm #Atten 10 dB

#Peak Log 10 dB/Offst 45.3 dB

Center 5.795 00 GHz Span 80 MHz

#Res BW 100 kHz #VBW 100 kHz #Sweep 5 s (601 pts)

|                            |                     |             |
|----------------------------|---------------------|-------------|
| <b>Occupied Bandwidth</b>  | <b>Occ BW % Pwr</b> | 99.00 %     |
| 36.4237 MHz                | x dB                | -6.00 dB    |
| <b>Transmit Freq Error</b> |                     | -47.170 kHz |
| <b>x dB Bandwidth</b>      |                     | 36.435 MHz* |

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**Measure**

Meas Off

Channel Power

Occupied BW

ACP

Multi Carrier Power

Power Stat CCDF

More  
1 of 2

6dB Bandwidth, 5785/5805 MHz, m0, HT-40 (with and without Beam Forming / STBC)

**Agilent**

Ch Freq 5.795 GHz Trig Free

Occupied Bandwidth

Ref 20 dBm #Atten 10 dB

#Peak Log 10 dB/Offst 45.3 dB

Center 5.795 00 GHz Span 80 MHz

#Res BW 100 kHz #VBW 100 kHz #Sweep 5 s (601 pts)

|                            |                     |             |
|----------------------------|---------------------|-------------|
| <b>Occupied Bandwidth</b>  | <b>Occ BW % Pwr</b> | 99.00 %     |
| 36.2625 MHz                | x dB                | -6.00 dB    |
| <b>Transmit Freq Error</b> |                     | -13.788 kHz |
| <b>x dB Bandwidth</b>      |                     | 36.441 MHz* |

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**Measure**

Meas Off

Channel Power

Occupied BW

ACP

Multi Carrier Power

Power Stat CCDF

More  
1 of 2





## 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   |

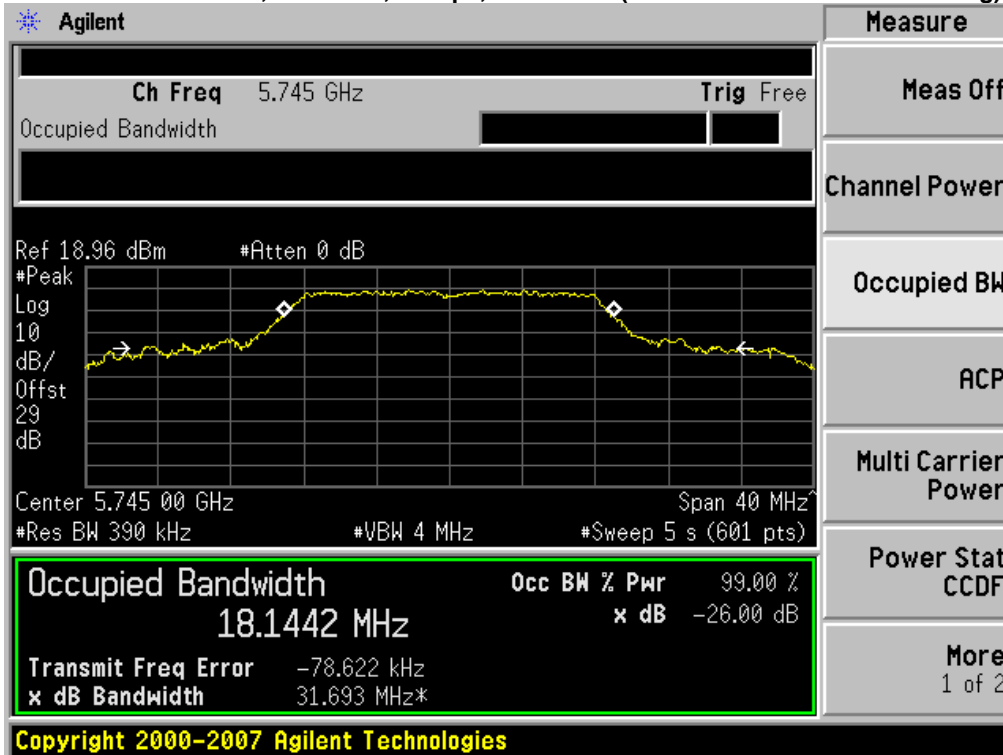
Place the radio in continuous transmit mode. View the transmitter waveform on the spectrum analyzer, and record the pertinent measurements:



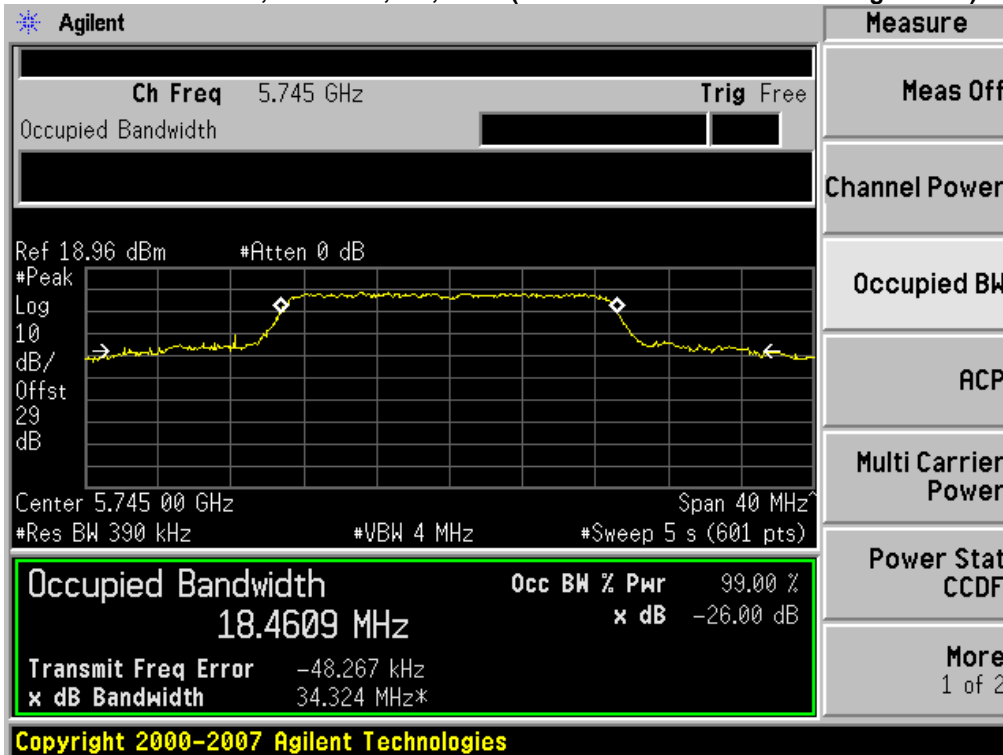
| Frequency (MHz) | Mode                                 | Data Rate (Mbps) | 26dB BW (MHz) | 99% BW (MHz) |
|-----------------|--------------------------------------|------------------|---------------|--------------|
| 5745            | Non HT-20, 6 to 54 Mbps              | 6                | 31.7          | 18.1         |
|                 | Non HT-20 Beam Forming, 6 to 54 Mbps | 6                | 31.7          | 18.1         |
|                 | HT-20, M0 to M23                     | m0               | 34.3          | 18.5         |
|                 | HT-20 STBC, M0 to M7                 | m0               | 34.3          | 18.5         |
|                 | HT-20 Beam Forming, M0 to M23        | m0               | 34.3          | 18.5         |
| 5785            | Non HT-20, 6 to 54 Mbps              | 6                | 32.5          | 18.2         |
|                 | Non HT-20 Beam Forming, 6 to 54 Mbps | 6                | 32.5          | 18.2         |
|                 | HT-20, M0 to M23                     | m0               | 43.7          | 37.3         |
|                 | HT-20 STBC, M0 to M7                 | m0               | 43.7          | 37.3         |
|                 | HT-20 Beam Forming, M0 to M23        | m0               | 43.7          | 37.3         |
| 5825            | Non HT-20, 6 to 54 Mbps              | 6                | 31.2          | 18.1         |
|                 | Non HT-20 Beam Forming, 6 to 54 Mbps | 6                | 31.2          | 18.1         |
|                 | HT-20, M0 to M23                     | m0               | 34.3          | 18.5         |
|                 | HT-20 STBC, M0 to M7                 | m0               | 34.3          | 18.5         |
|                 | HT-20 Beam Forming, M0 to M23        | m0               | 34.3          | 18.5         |
| 5745/5765       | Non HT-40 Duplicate, 6-54 Mbps       | 6                | 76.9          | 47.5         |
|                 | HT-40, M0 to M23                     | m0               | 72.8          | 37.8         |
|                 | HT-40 STBC, M0 to M7                 | m0               | 72.8          | 37.8         |
|                 | HT-40 Beam Forming, M0 to M23        | m0               | 72.8          | 37.8         |
| 5785/5805       | Non HT-40 Duplicate, 6-54 Mbps       | 6                | 76.7          | 46           |
|                 | HT-40, M0 to M23                     | m0               | 72.4          | 37.7         |
|                 | HT-40 STBC, M0 to M7                 | m0               | 72.4          | 37.7         |
|                 | HT-40 Beam Forming, M0 to M23        | m0               | 72.4          | 37.7         |



26dB / 99% Bandwidth, 5745 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)



26dB / 99% Bandwidth, 5745 MHz, m0, HT20 (with and without Beam Forming / STBC)





26dB / 99% Bandwidth, 5785 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)

Agilent

Ch Freq 5.785 GHz Trig Free

Occupied Bandwidth

Ref 18.11 dBm #Atten 0 dB

#Peak

Log

10

dB/

Offst

28.1

dB

Center 5.785 00 GHz Span 40 MHz

#Res BW 390 kHz #VBW 4 MHz #Sweep 5 s (601 pts)

**Occupied Bandwidth** Occ BW % Pwr 99.00 %

**18.1681 MHz** x dB -26.00 dB

Transmit Freq Error -74.248 kHz

x dB Bandwidth 32.514 MHz\*

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Measure

Meas Off

Channel Power

Occupied BW

ACP

Multi Carrier Power

Power Stat CCDF

More 1 of 2

26dB / 99% Bandwidth, 5785 MHz, m0, HT20 (with and without Beam Forming / STBC)

Agilent

Ch Freq 5.795 GHz Trig Free

Occupied Bandwidth

Ref 20 dBm #Atten 0 dB

#Peak

Log

10

dB/

Offst

45.3

dB

Center 5.795 00 GHz Span 80 MHz

#Res BW 750 kHz #VBW 8 MHz #Sweep 5 s (601 pts)

**Occupied Bandwidth** Occ BW % Pwr 99.00 %

**37.3268 MHz** x dB -26.00 dB

Transmit Freq Error -61.344 kHz

x dB Bandwidth 43.670 MHz\*

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Measure

Meas Off

Channel Power

Occupied BW

ACP

Multi Carrier Power

Power Stat CCDF

More 1 of 2



26dB / 99% Bandwidth, 5825 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)

Agilent

Ch Freq 5.825 GHz Trig Free

Occupied Bandwidth

Ref 17.8 dBm #Atten 0 dB

#Peak Log 10 dB/Offst 27.8 dB

Center 5.825 00 GHz Span 40 MHz

#Res BW 390 kHz #VBW 4 MHz #Sweep 5 s (601 pts)

|                            |                     |              |
|----------------------------|---------------------|--------------|
| <b>Occupied Bandwidth</b>  | <b>Occ BW % Pwr</b> | 99.00 %      |
| 18.1225 MHz                | x dB                | -26.00 dB    |
| <b>Transmit Freq Error</b> |                     | -154.357 kHz |
| x dB Bandwidth             |                     | 31.244 MHz*  |

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Measure

Meas Off

Channel Power

Occupied BW

ACP

Multi Carrier Power

Power Stat CCDF

More 1 of 2

26dB / 99% Bandwidth, 5825 MHz, m0, HT20 (with and without Beam Forming / STBC)

Agilent

Ch Freq 5.825 GHz Trig Free

Occupied Bandwidth

Ref 17.8 dBm #Atten 0 dB

#Peak Log 10 dB/Offst 27.8 dB

Center 5.825 00 GHz Span 40 MHz

#Res BW 390 kHz #VBW 4 MHz #Sweep 5 s (601 pts)

|                            |                     |             |
|----------------------------|---------------------|-------------|
| <b>Occupied Bandwidth</b>  | <b>Occ BW % Pwr</b> | 99.00 %     |
| 18.4546 MHz                | x dB                | -26.00 dB   |
| <b>Transmit Freq Error</b> |                     | -67.571 kHz |
| x dB Bandwidth             |                     | 34.263 MHz* |

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Measure

Meas Off

Channel Power

Occupied BW

ACP

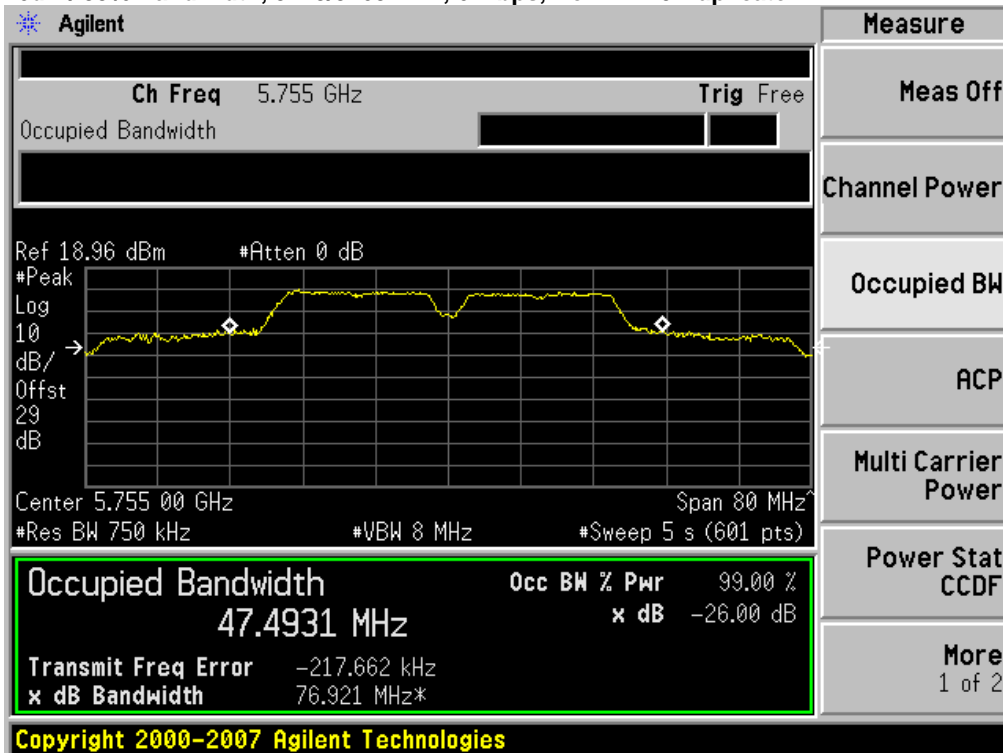
Multi Carrier Power

Power Stat CCDF

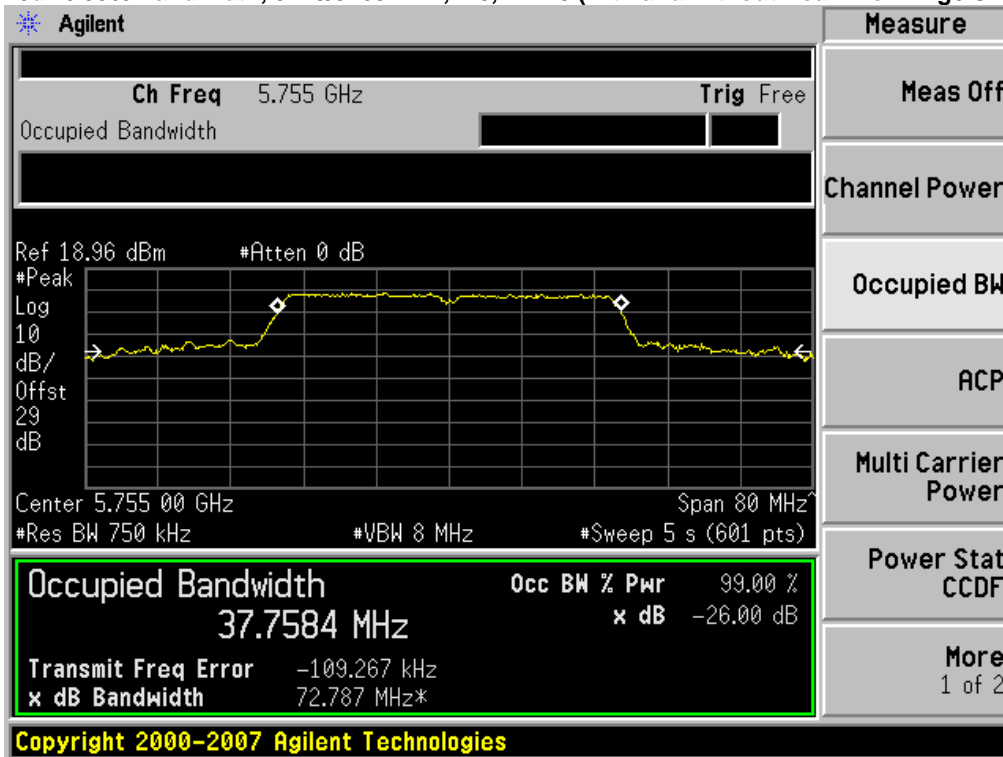
More 1 of 2



26dB / 99% Bandwidth, 5745/5765 MHz, 6 Mbps, Non HT-40 Duplicate

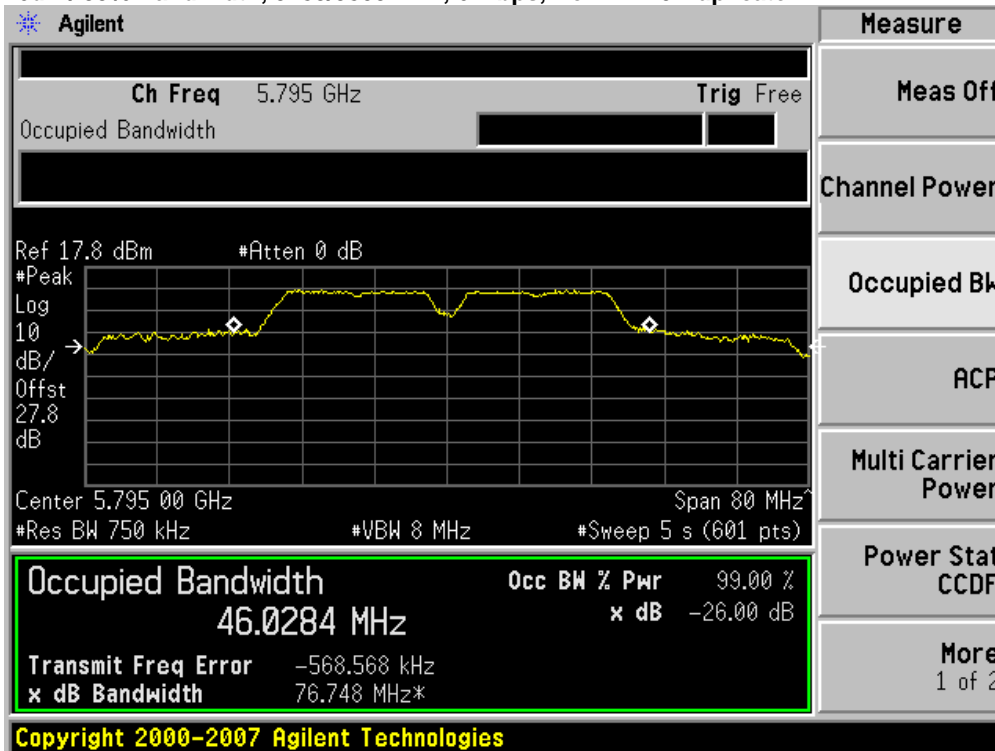


26dB / 99% Bandwidth, 5745/5765 MHz, m0, HT-40 (with and without Beam Forming / STBC)

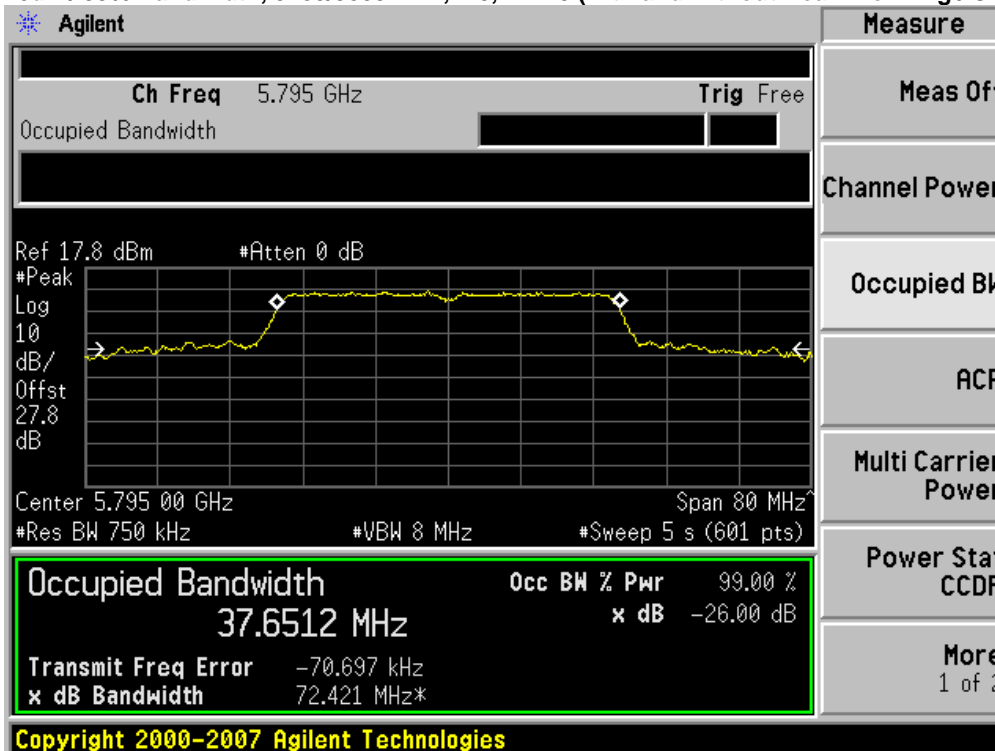




26dB / 99% Bandwidth, 5785/5805 MHz, 6 Mbps, Non HT-40 Duplicate



26dB / 99% Bandwidth, 5785/5805 MHz, m0, HT-40 (with and without Beam Forming / STBC)





## Peak Output Power

15.247: 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 6dBi. 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.

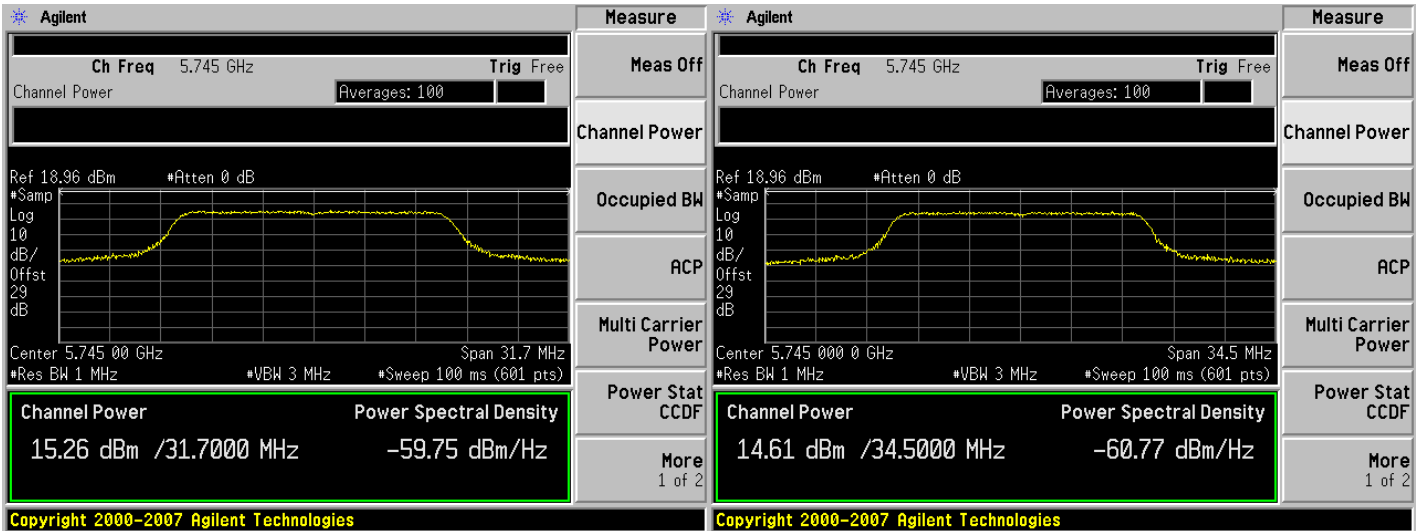




| Frequency (MHz) | Operating Mode                       | Tx Paths | Correlated Antenna Gain (dBi) | Tx 1 Peak Power (dBm) | Tx 2 Peak Power (dBm) | Tx 3 Peak Power (dBm) | Tx 4 Peak Power (dBm) | Total Tx Channel Power (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|--------------------------------------|----------|-------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------------|-------------|-------------|
| 5745            | Non HT-20, 6 to 54 Mbps              | 4        | 6                             | 15.3                  | 14.6                  | 15.6                  | 15.3                  | 21.2                         | 30          | 8.8         |
|                 | Non HT-20 Beam Forming, 6 to 54 Mbps | 4        | 12                            | 15.3                  | 14.6                  | 15.6                  | 15.3                  | 21.2                         | 24          | 2.8         |
|                 | HT-20, M0 to M23                     | 4        | 6                             | 15.3                  | 14.6                  | 15.5                  | 15.3                  | 21.2                         | 30          | 8.8         |
|                 | HT-20 STBC, M0 to M7                 | 4        | 6                             | 15.3                  | 14.6                  | 15.5                  | 15.3                  | 21.2                         | 30          | 8.8         |
|                 | HT-20 Beam Forming, M0 to M7         | 4        | 12                            | 15.3                  | 14.6                  | 15.5                  | 15.3                  | 21.2                         | 24          | 2.8         |
|                 | HT-20 Beam Forming, M8 to M15        | 4        | 9                             | 15.3                  | 14.6                  | 15.5                  | 15.3                  | 21.2                         | 27          | 5.8         |
|                 | HT-20 Beam Forming, M16 to M23       | 4        | 7                             | 15.3                  | 14.6                  | 15.5                  | 15.3                  | 21.2                         | 29          | 7.5         |
| 5785            | Non HT-20, 6 to 54 Mbps              | 4        | 6                             | 14.6                  | 14.2                  | 14.5                  | 14.9                  | 20.6                         | 30          | 9.4         |
|                 | Non HT-20 Beam Forming, 6 to 54 Mbps | 4        | 12                            | 14.6                  | 14.2                  | 14.5                  | 14.9                  | 20.6                         | 24          | 3.4         |
|                 | HT-20, M0 to M23                     | 4        | 6                             | 14.5                  | 14.2                  | 14.5                  | 14.9                  | 20.6                         | 30          | 9.4         |
|                 | HT-20 STBC, M0 to M7                 | 4        | 6                             | 14.5                  | 14.2                  | 14.5                  | 14.9                  | 20.6                         | 30          | 9.4         |
|                 | HT-20 Beam Forming, M0 to M7         | 4        | 12                            | 14.5                  | 14.2                  | 14.5                  | 14.9                  | 20.6                         | 24          | 3.4         |
|                 | HT-20 Beam Forming, M8 to M15        | 4        | 9                             | 14.5                  | 14.2                  | 14.5                  | 14.9                  | 20.6                         | 27          | 6.4         |
|                 | HT-20 Beam Forming, M16 to M23       | 4        | 7                             | 14.5                  | 14.2                  | 14.5                  | 14.9                  | 20.6                         | 29          | 8.2         |
| 5825            | Non HT-20, 6 to 54 Mbps              | 4        | 6                             | 14.2                  | 14.7                  | 14.5                  | 14.9                  | 20.6                         | 30          | 9.4         |
|                 | Non HT-20 Beam Forming, 6 to 54 Mbps | 4        | 12                            | 14.2                  | 14.7                  | 14.5                  | 14.9                  | 20.6                         | 24          | 3.4         |
|                 | HT-20, M0 to M23                     | 4        | 6                             | 14.4                  | 14.4                  | 14.3                  | 14.7                  | 20.5                         | 30          | 9.5         |
|                 | HT-20 STBC, M0 to M7                 | 4        | 6                             | 14.4                  | 14.4                  | 14.3                  | 14.7                  | 20.5                         | 30          | 9.5         |
|                 | HT-20 Beam Forming, M0 to M7         | 4        | 12                            | 14.4                  | 14.4                  | 14.3                  | 14.7                  | 20.5                         | 24          | 3.5         |
|                 | HT-20 Beam Forming, M8 to M15        | 4        | 9                             | 14.4                  | 14.4                  | 14.3                  | 14.7                  | 20.5                         | 27          | 6.5         |
|                 | HT-20 Beam Forming, M16 to M23       | 4        | 7                             | 14.4                  | 14.4                  | 14.3                  | 14.7                  | 20.5                         | 29          | 8.3         |
| 5745/5765       | Non HT-40 Duplicate, 6-54 Mbps       | 4        | 6                             | 15.4                  | 14.8                  | 15.6                  | 15.6                  | 21.4                         | 30          | 8.6         |
|                 | HT-40, M0 to M23                     | 4        | 6                             | 15.2                  | 14.3                  | 15.2                  | 15.2                  | 21.0                         | 30          | 9.0         |
|                 | HT-40 STBC, M0 to M7                 | 4        | 6                             | 15.2                  | 14.3                  | 15.2                  | 15.2                  | 21.0                         | 30          | 9.0         |
|                 | HT-40 Beam Forming, M0 to M7         | 4        | 12                            | 15.2                  | 14.3                  | 15.2                  | 15.2                  | 21.0                         | 24          | 3.0         |
|                 | HT-40 Beam Forming, M8 to M15        | 4        | 9                             | 15.2                  | 14.3                  | 15.2                  | 15.2                  | 21.0                         | 27          | 6.0         |
|                 | HT-40 Beam Forming, M16 to M23       | 4        | 7                             | 15.2                  | 14.3                  | 15.2                  | 15.2                  | 21.0                         | 29          | 7.7         |
| 5785/5805       | Non HT-40 Duplicate, 6-54 Mbps       | 4        | 6                             | 14.5                  | 14.4                  | 14.5                  | 15.1                  | 20.7                         | 30          | 9.3         |
|                 | HT-40, M0 to M23                     | 4        | 6                             | 14.2                  | 13.9                  | 14.0                  | 14.8                  | 20.3                         | 30          | 9.7         |
|                 | HT-40 STBC, M0 to M7                 | 4        | 6                             | 14.2                  | 13.9                  | 14.0                  | 14.8                  | 20.3                         | 30          | 9.7         |
|                 | HT-40 Beam Forming, M0 to M7         | 4        | 12                            | 14.2                  | 13.9                  | 14.0                  | 14.8                  | 20.3                         | 24          | 3.7         |
|                 | HT-40 Beam Forming, M8 to M15        | 4        | 9                             | 14.2                  | 13.9                  | 14.0                  | 14.8                  | 20.3                         | 27          | 6.7         |
|                 | HT-40 Beam Forming, M16 to M23       | 4        | 7                             | 14.2                  | 13.9                  | 14.0                  | 14.8                  | 20.3                         | 29          | 8.5         |

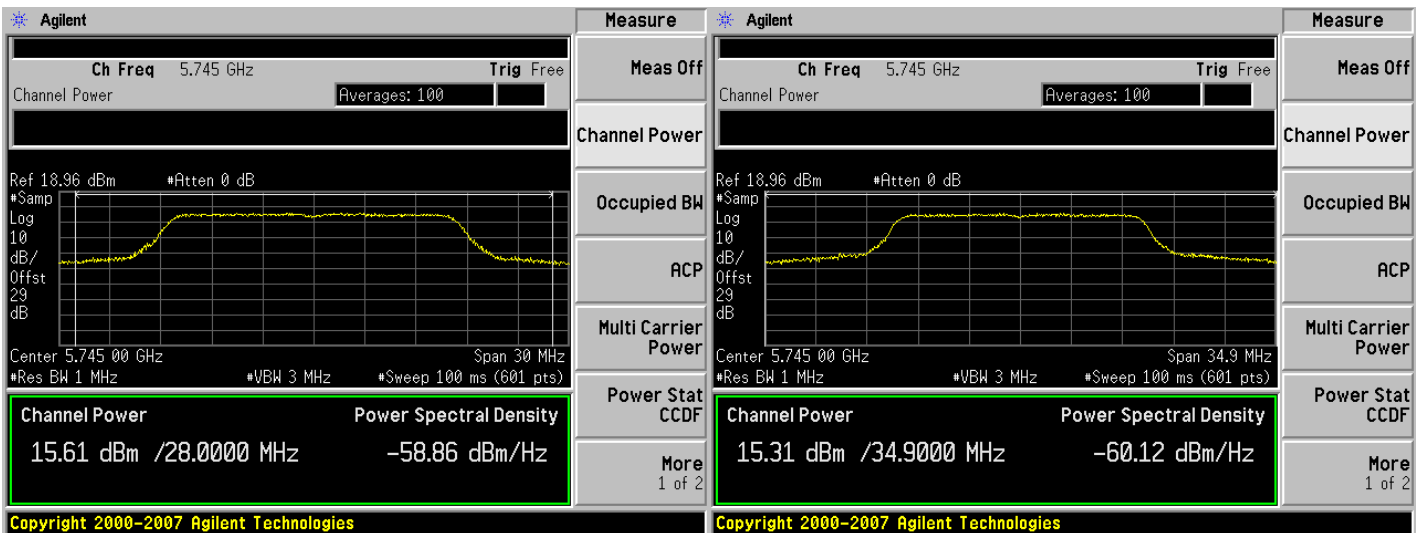


Peak Output Power, 5745 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)



Antenna A

Antenna B

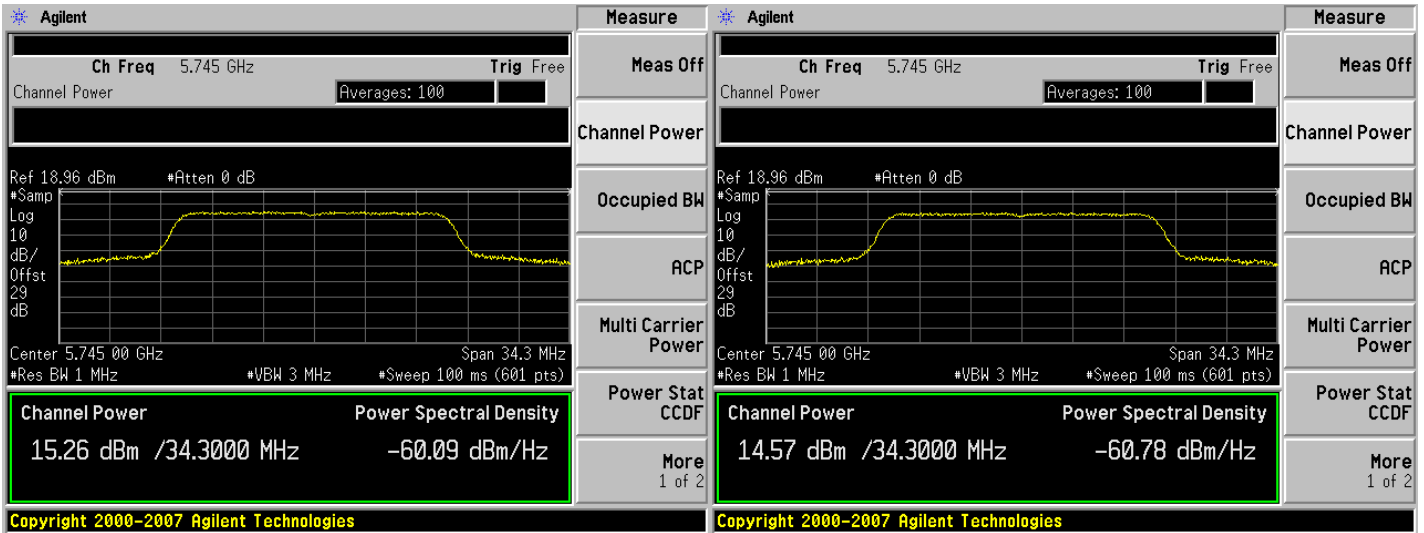


Antenna C

Antenna D

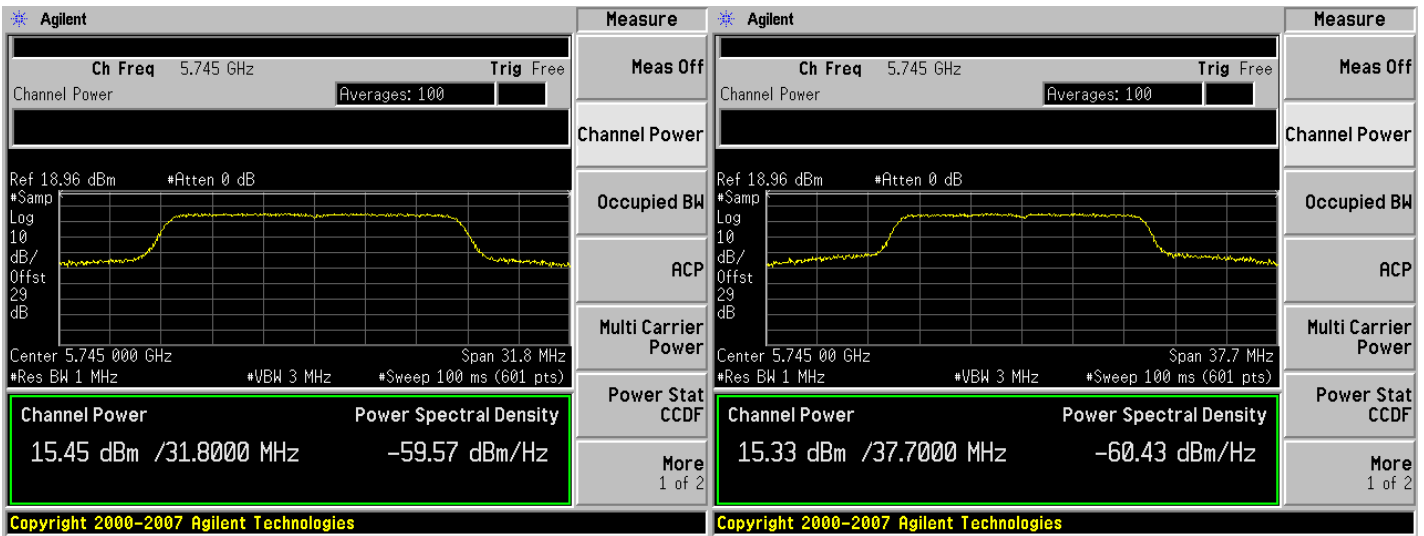


Peak Output Power, 5745 MHz, m0-m23, HT20 (with and without Beam Forming / STBC)



Antenna A

Antenna B

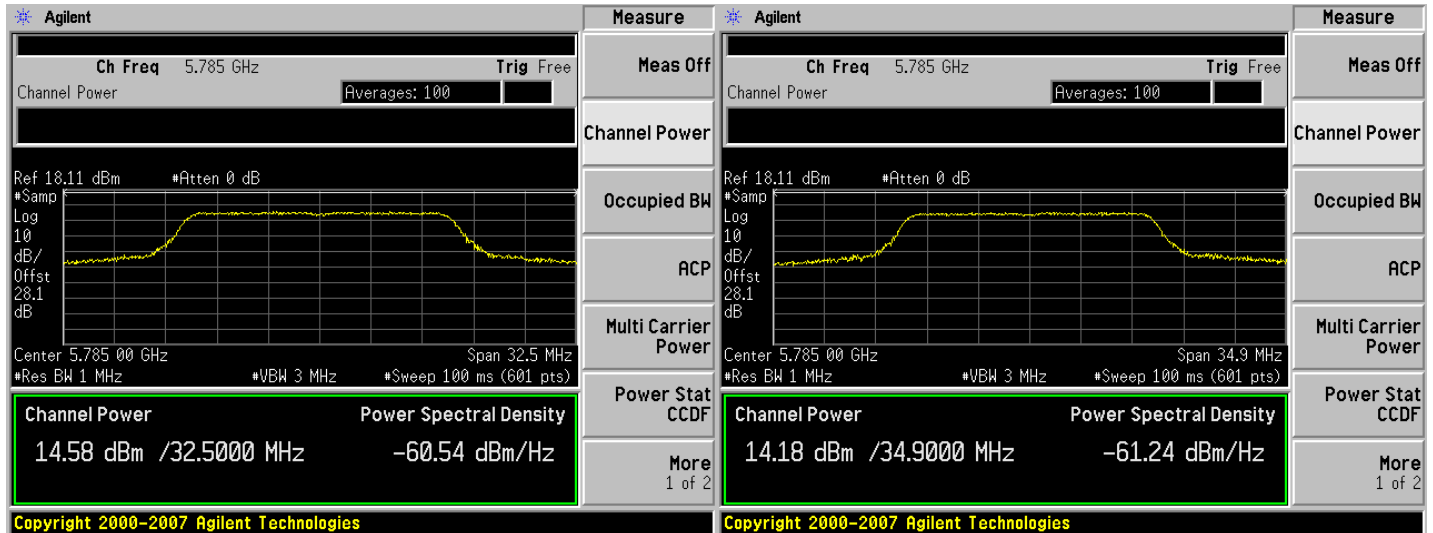


Antenna C

Antenna D

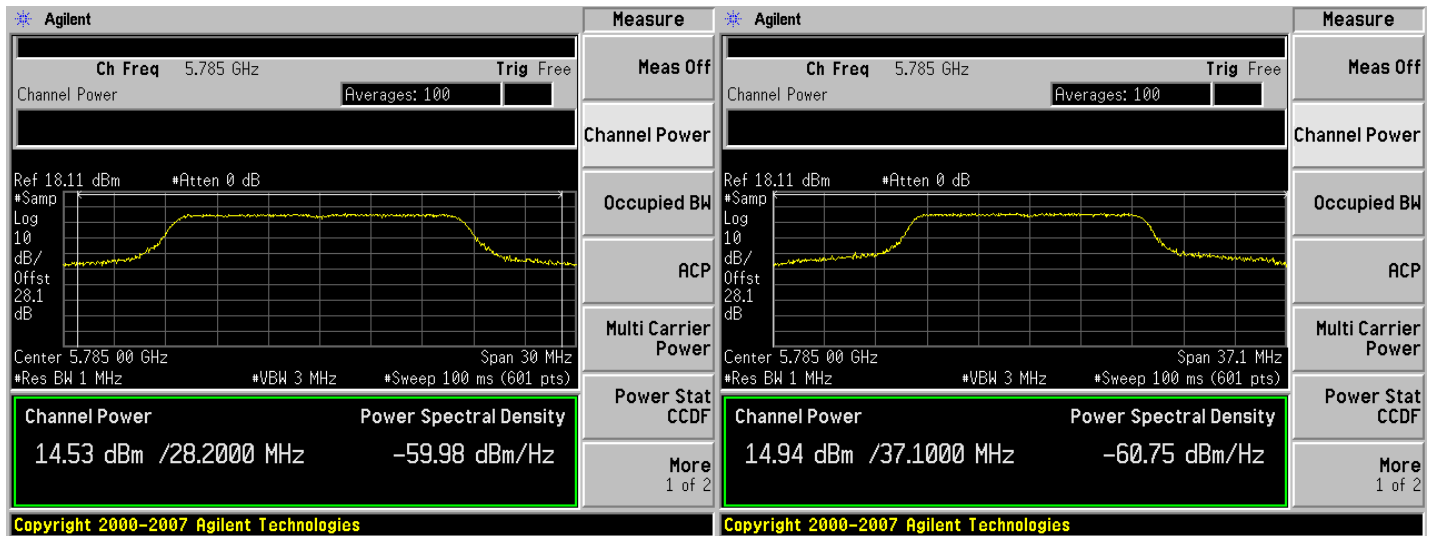


Peak Output Power, 5785 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)



Antenna A

Antenna B

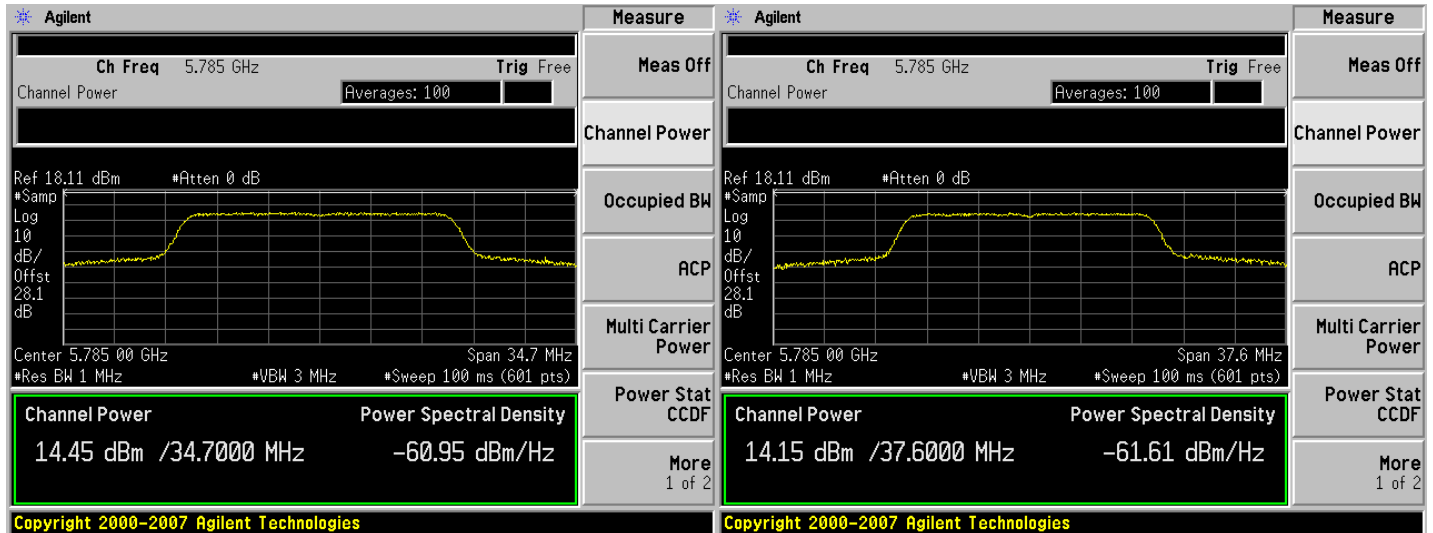


Antenna C

Antenna D

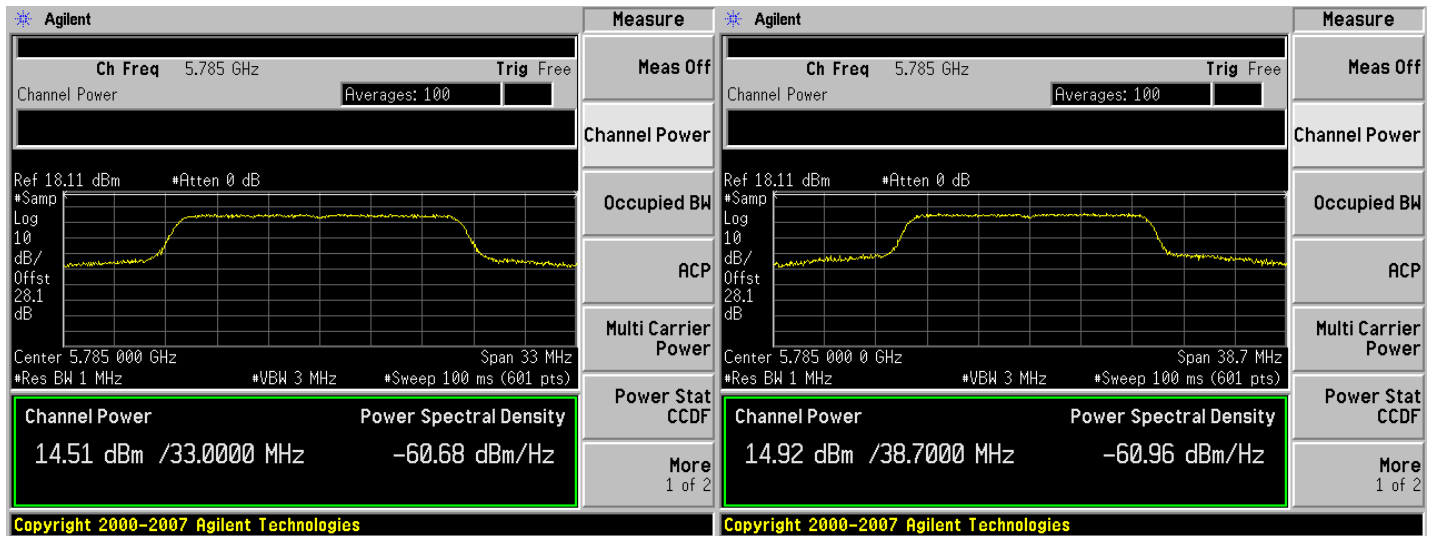


Peak Output Power, 5785 MHz, m0-m23, HT20 (with and without Beam Forming / STBC)



Antenna A

Antenna B

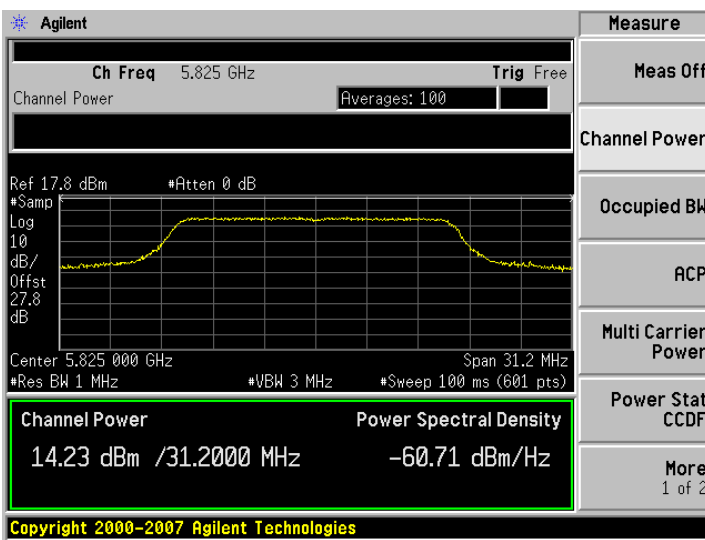


Antenna C

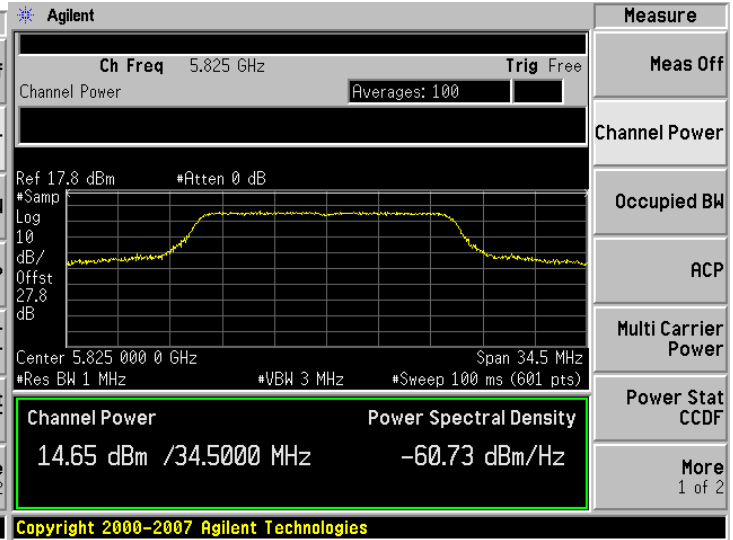
Antenna D



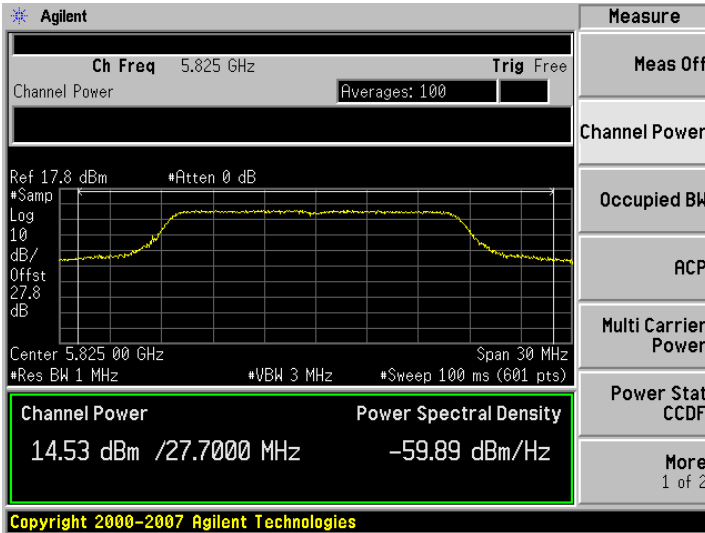
Peak Output Power, 5825 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)



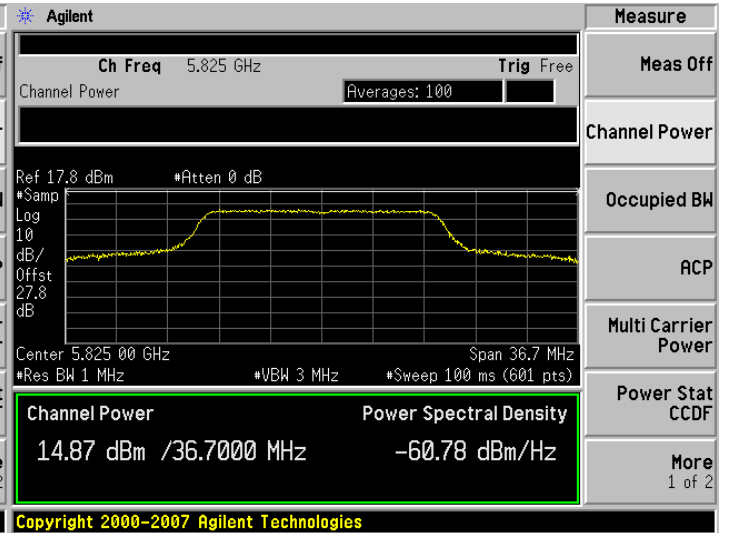
Antenna A



Antenna B



Antenna C



Antenna D

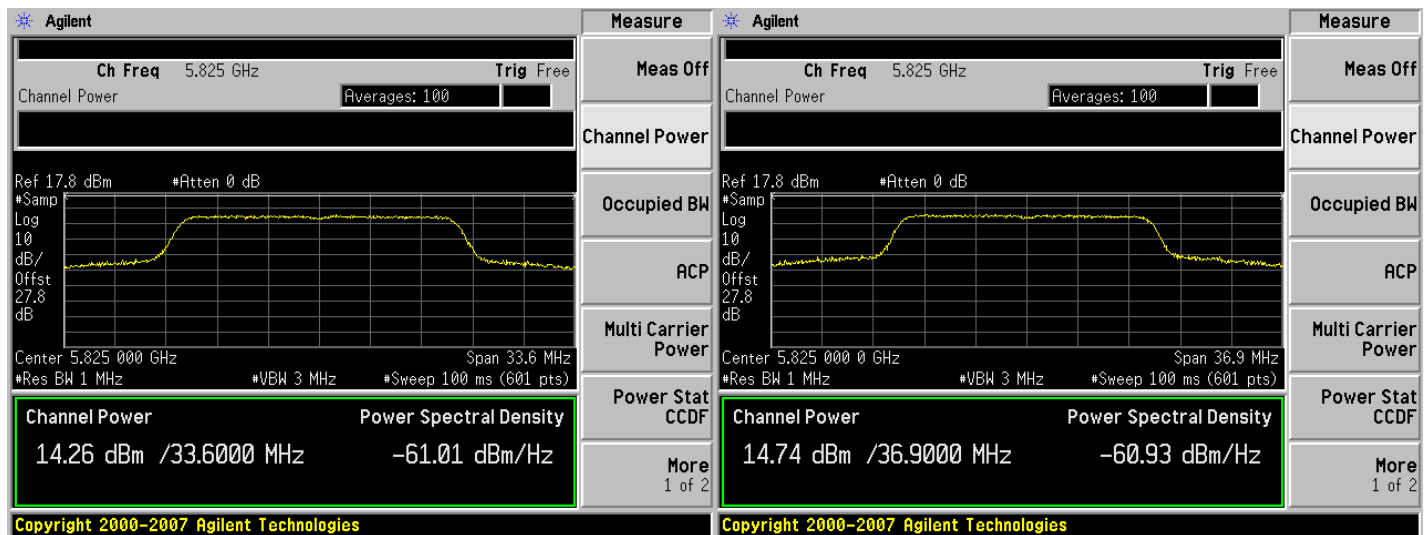


Peak Output Power, 5825 MHz, m0-m23, HT20 (with and without Beam Forming / STBC)



Antenna A

Antenna B

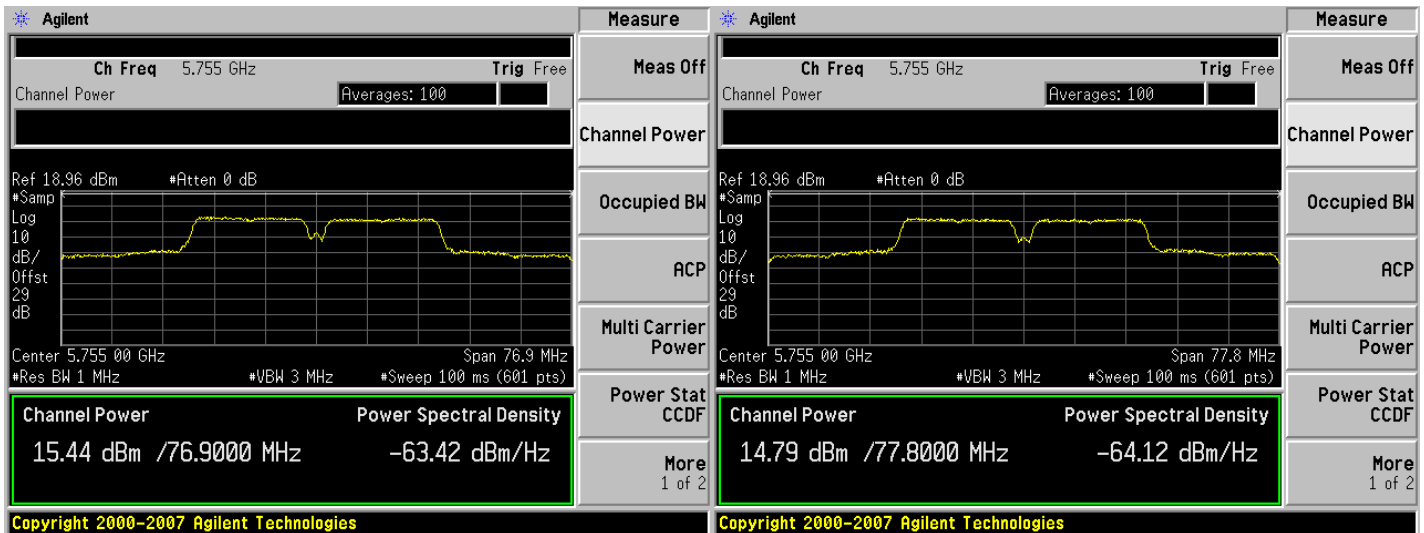


Antenna C

Antenna D

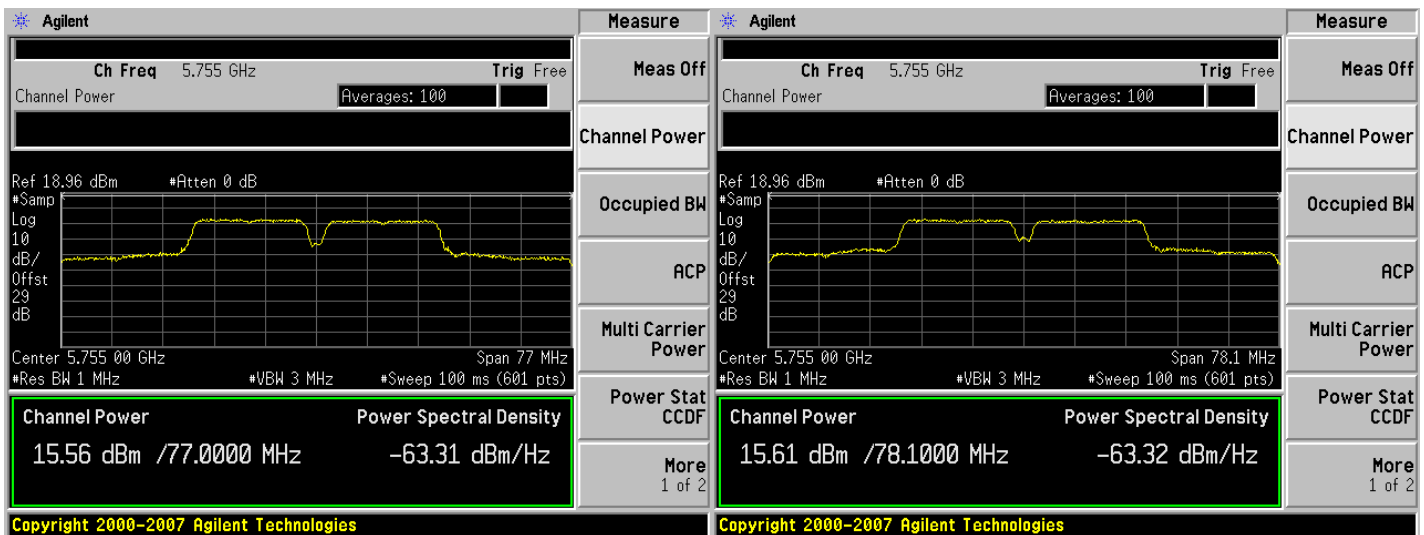


Peak Output Power, 5745/5765 MHz, 6 Mbps, Non-HT40



Antenna A

Antenna B



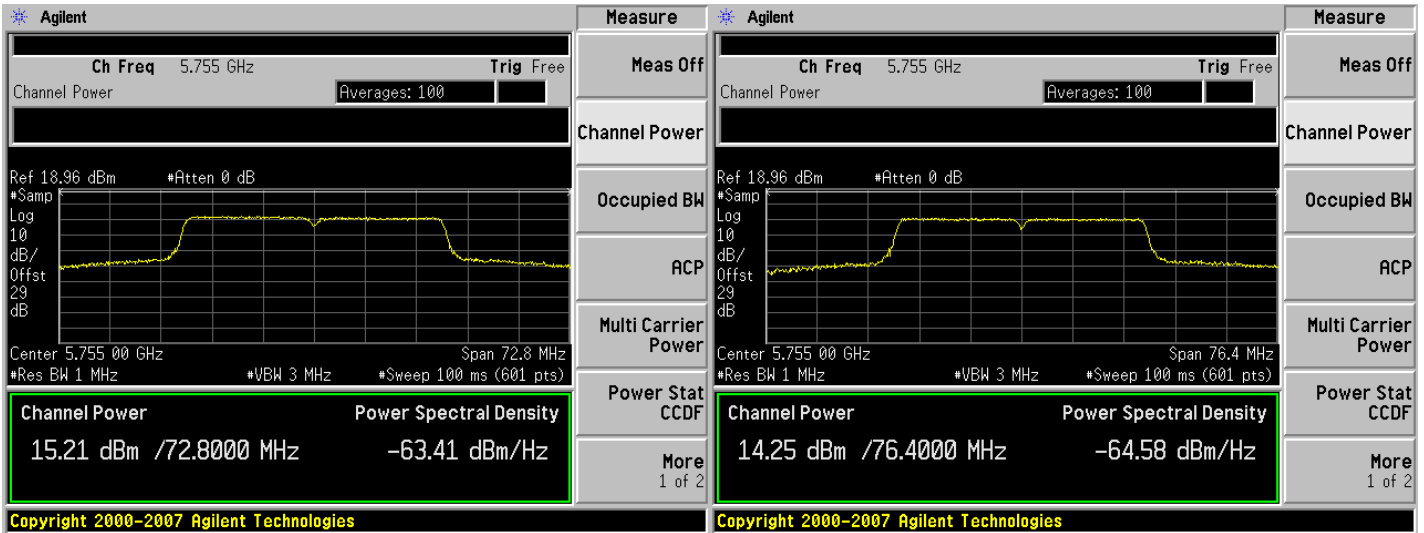
Antenna C

Antenna D



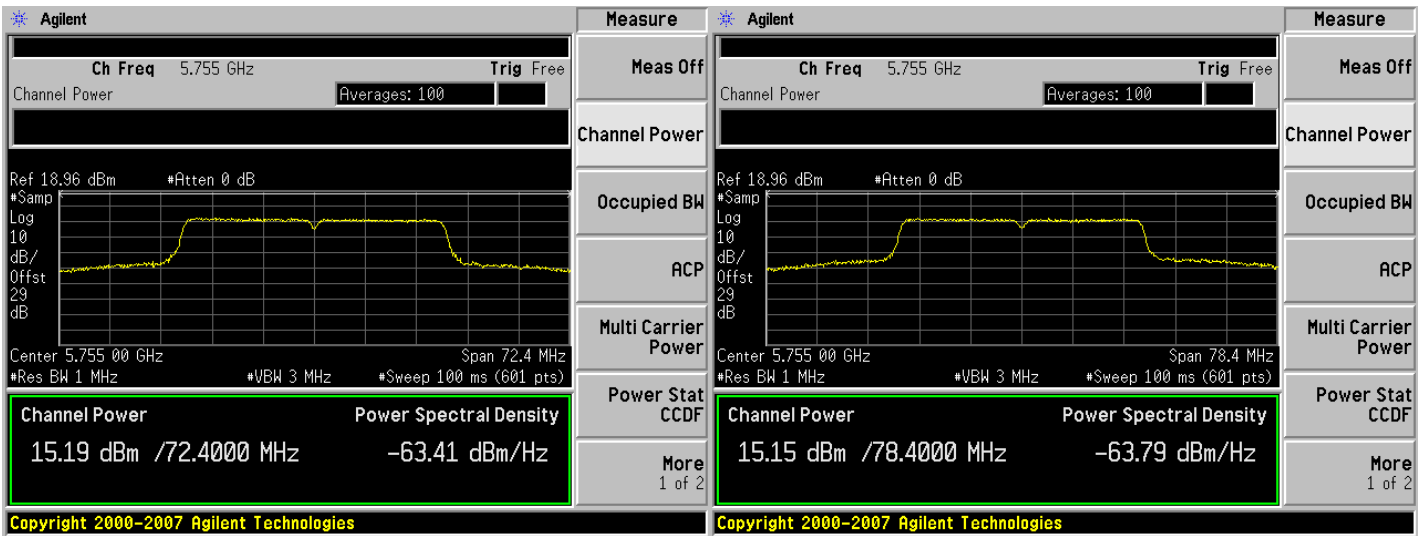


Peak Output Power, 5745/5765 MHz, m0-m23, HT40 (with and without Beam Forming / STBC)



Antenna A

Antenna B

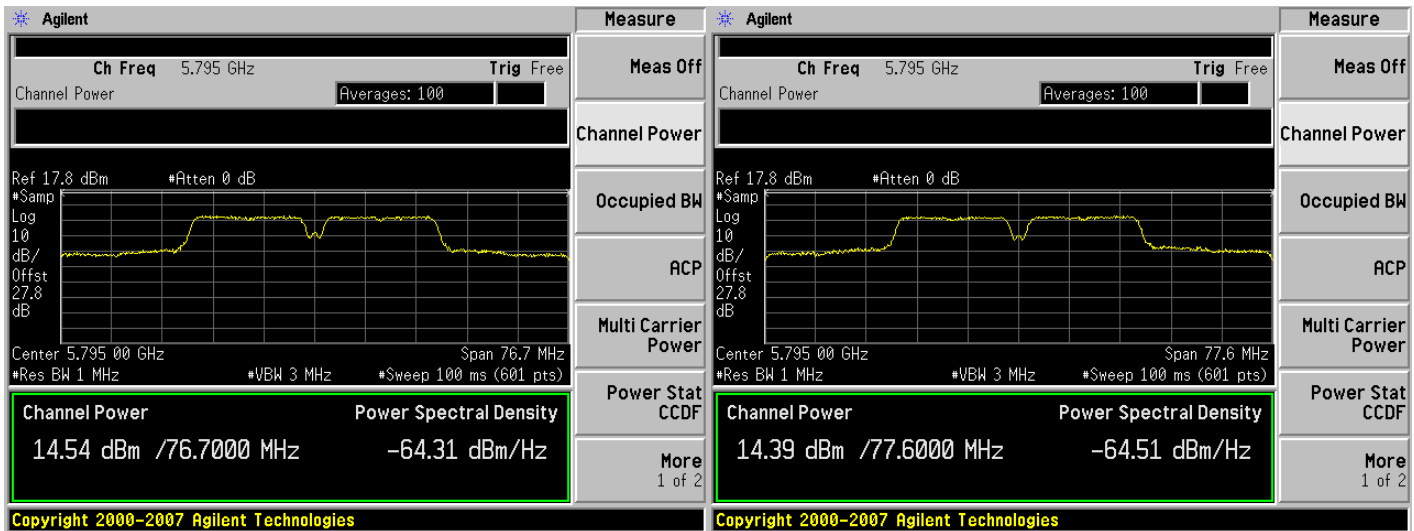


Antenna C

Antenna D



Peak Output Power, 5785/5805 MHz, 6 Mbps, Non-HT40



Antenna A

Antenna B

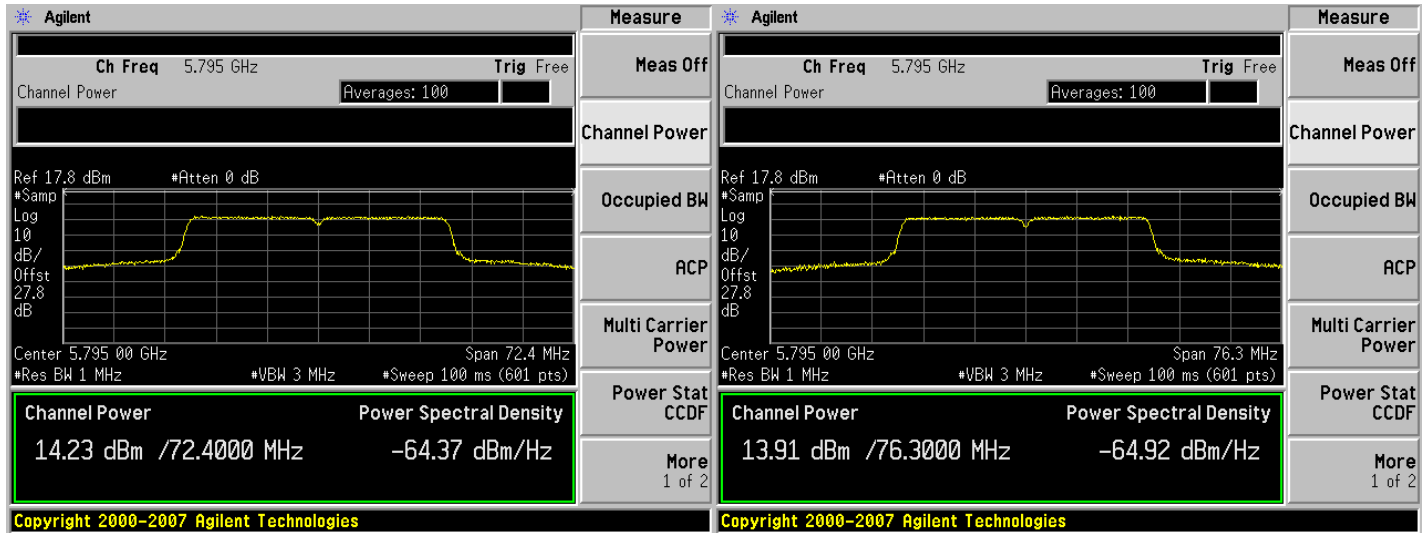


Antenna C

Antenna D

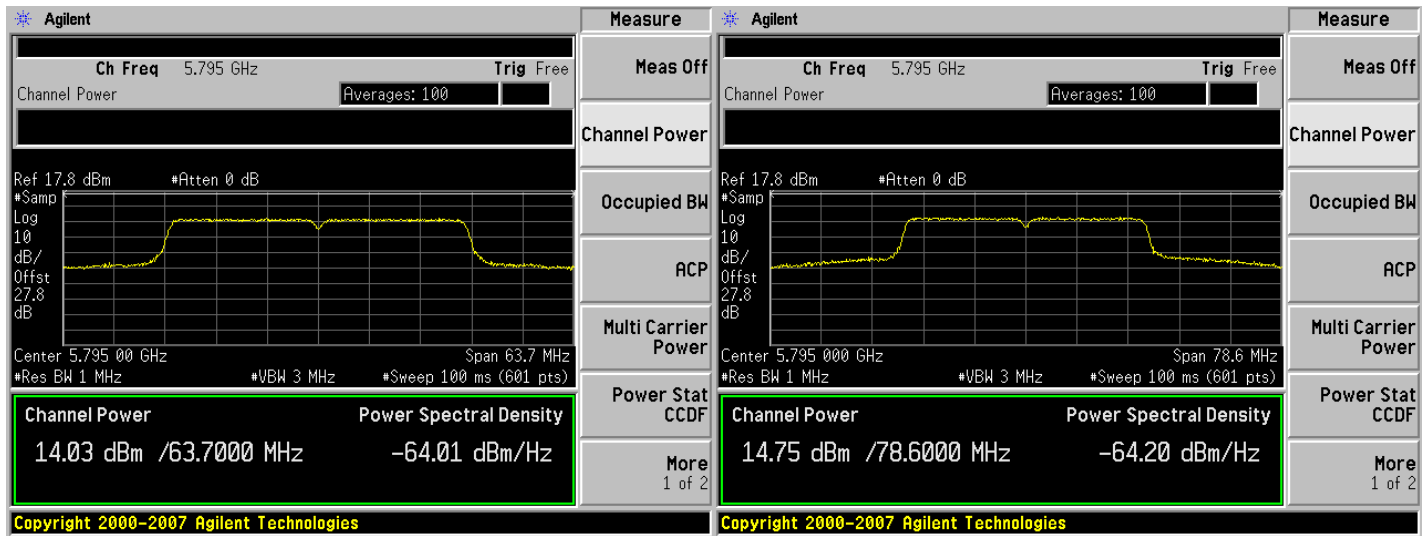


Peak Output Power, 5785/5805 MHz, m0-m23, HT40 (with and without Beam Forming / STBC)



Antenna A

Antenna B



Antenna C

Antenna D



## Power Spectral Density

15.247: 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.

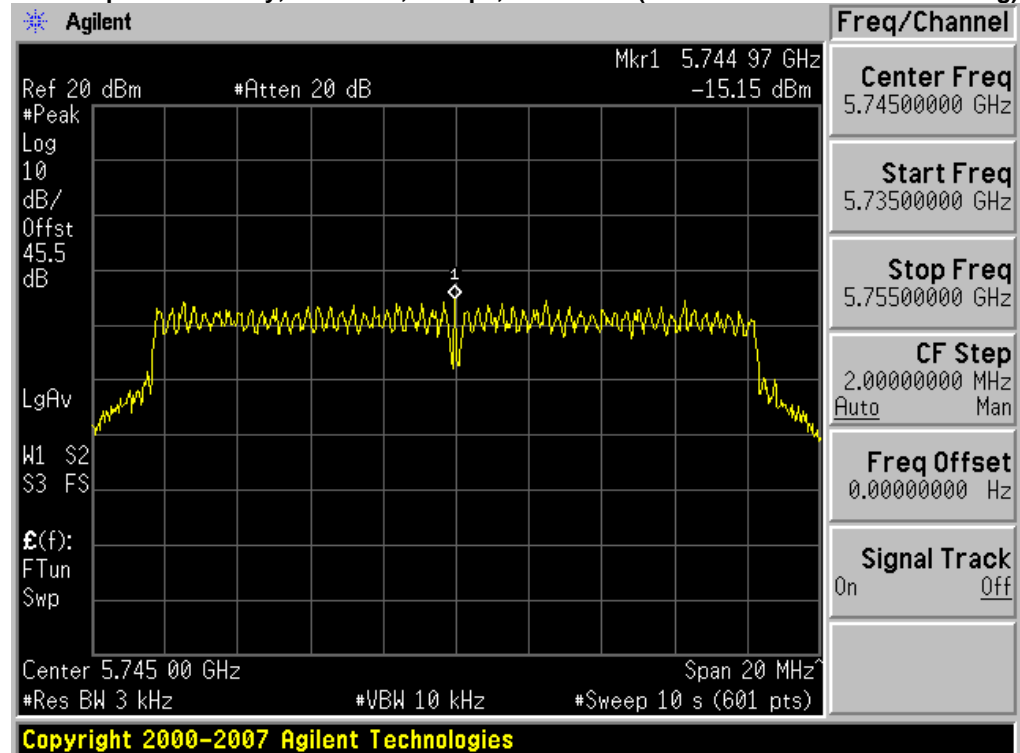
The "Measure and add  $10 \log(N)$  dB technique", where N is the number of outputs, is used for measuring in-band Power Spectral Density. With this technique, spectrum measurements are performed at each output of the device, and the quantity  $10 \log(4)$  (or 6dB) is added to the worst case spectrum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



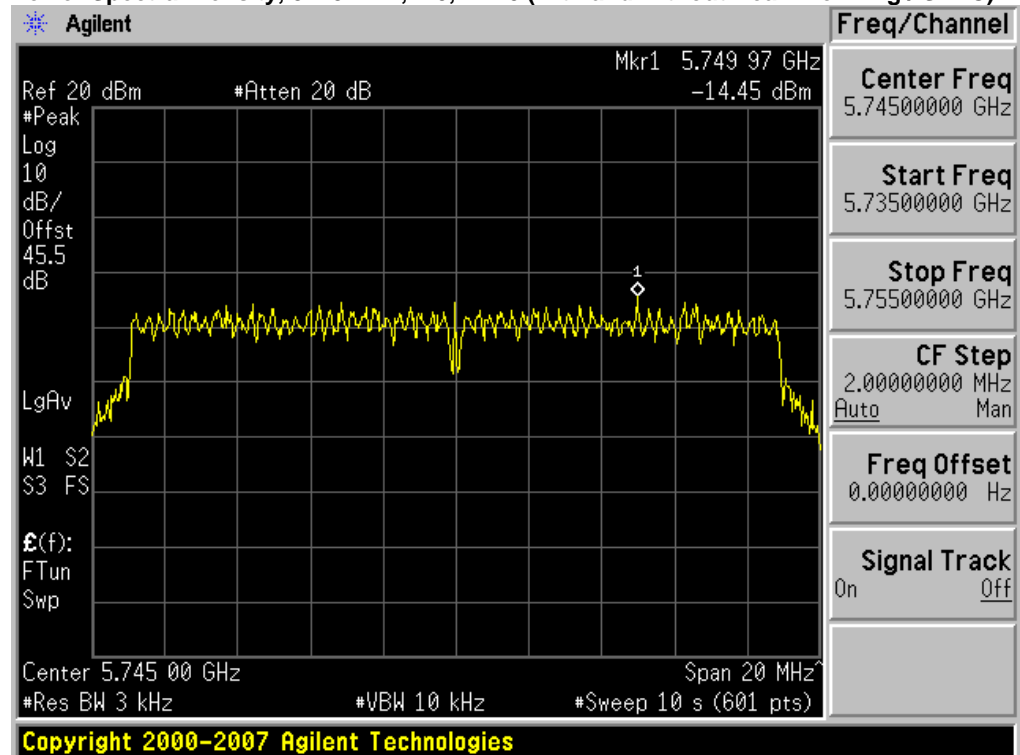
| Frequency (MHz) | Mode                                 | Data Rate (Mbps) | PSD / Antenna (dBm/3kHz) | Total PSD (dBm/3kHz) | Limit (dBm/3kHz) |
|-----------------|--------------------------------------|------------------|--------------------------|----------------------|------------------|
| 5745            | Non HT-20, 6 to 54 Mbps              | 6                | -15.2                    | -9.1                 | 8                |
|                 | Non HT-20 Beam Forming, 6 to 54 Mbps | 6                | -15.2                    | -9.2                 | 8                |
|                 | HT-20, M0 to M23                     | m0               | -14.5                    | -8.4                 | 8                |
|                 | HT-20 STBC, M0 to M7                 | m0               | -14.5                    | -8.4                 | 8                |
|                 | HT-20 Beam Forming, M0 to M23        | m0               | -14.5                    | -8.4                 | 8                |
| 5785            | Non HT-20, 6 to 54 Mbps              | 6                | -15.4                    | -9.3                 | 8                |
|                 | Non HT-20 Beam Forming, 6 to 54 Mbps | 6                | -15.4                    | -9.3                 | 8                |
|                 | HT-20, M0 to M23                     | m0               | -15.7                    | -9.7                 | 8                |
|                 | HT-20 STBC, M0 to M7                 | m0               | -15.7                    | -9.7                 | 8                |
|                 | HT-20 Beam Forming, M0 to M23        | m0               | -15.7                    | -9.7                 | 8                |
| 5825            | Non HT-20, 6 to 54 Mbps              | 6                | -13.8                    | -7.8                 | 8                |
|                 | Non HT-20 Beam Forming, 6 to 54 Mbps | 6                | -13.8                    | -7.8                 | 8                |
|                 | HT-20, M0 to M23                     | m0               | -14.2                    | -8.2                 | 8                |
|                 | HT-20 STBC, M0 to M7                 | m0               | -14.2                    | -8.2                 | 8                |
|                 | HT-20 Beam Forming, M0 to M23        | m0               | -14.2                    | -8.2                 | 8                |
| 5745/5765       | Non HT-40 Duplicate, 6-54 Mbps       | 6                | -16.1                    | -10.1                | 8                |
|                 | HT-40, M0 to M23                     | m0               | -15.1                    | -9.1                 | 8                |
|                 | HT-40 STBC, M0 to M7                 | m0               | -15.1                    | -9.1                 | 8                |
|                 | HT-40 Beam Forming, M0 to M23        | m0               | -15.1                    | -9.1                 | 8                |
| 5785/5805       | Non HT-40 Duplicate, 6-54 Mbps       | 6                | -17.4                    | -11.4                | 8                |
|                 | HT-40, M0 to M23                     | m0               | -15.6                    | -9.6                 | 8                |
|                 | HT-40 STBC, M0 to M7                 | m0               | -15.6                    | -9.6                 | 8                |
|                 | HT-40 Beam Forming, M0 to M23        | m0               | -15.6                    | -9.6                 | 8                |



**Power Spectral Density, 5745 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)**

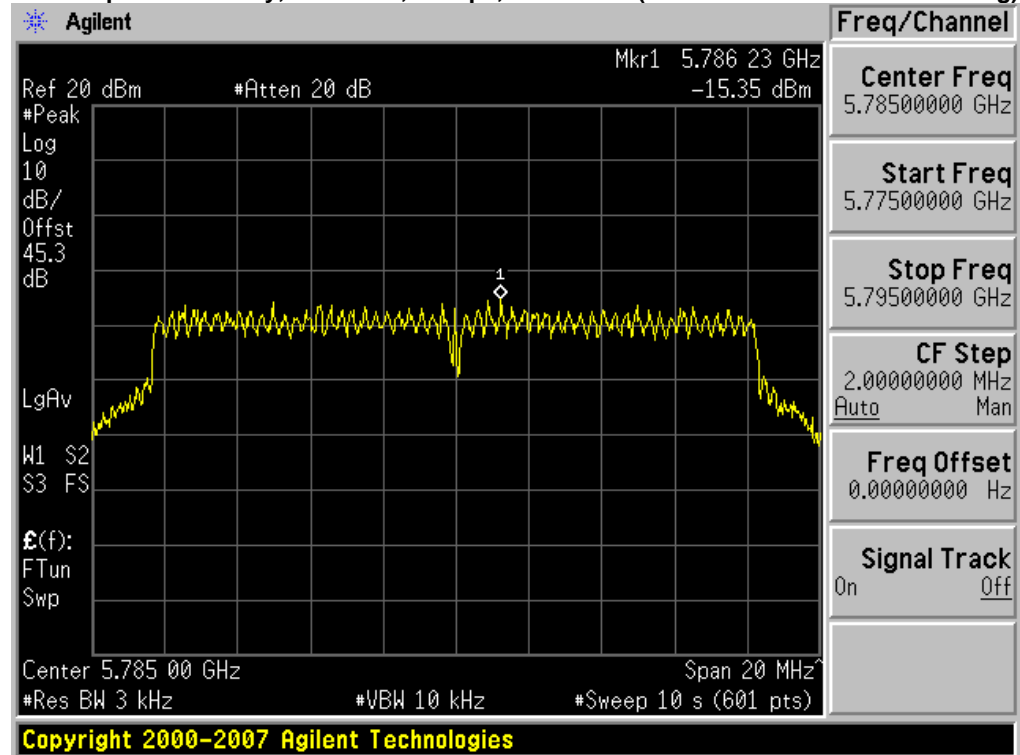


**Power Spectral Density, 5745 MHz, m0, HT20 (with and without Beam Forming / STBC)**

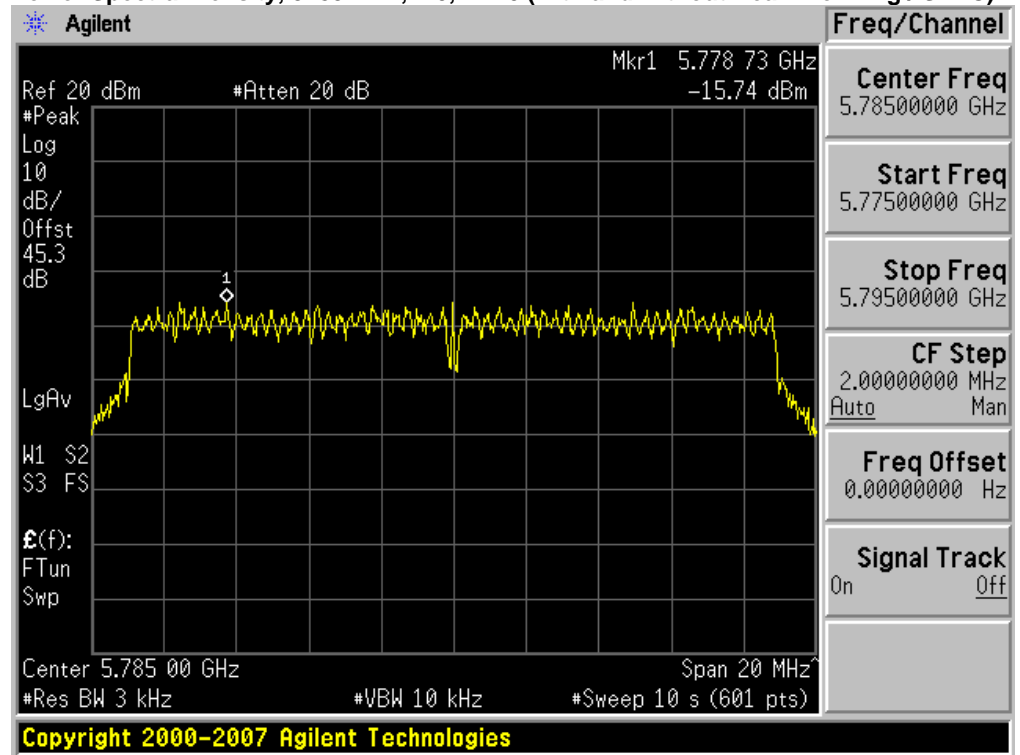




**Power Spectral Density, 5785 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)**

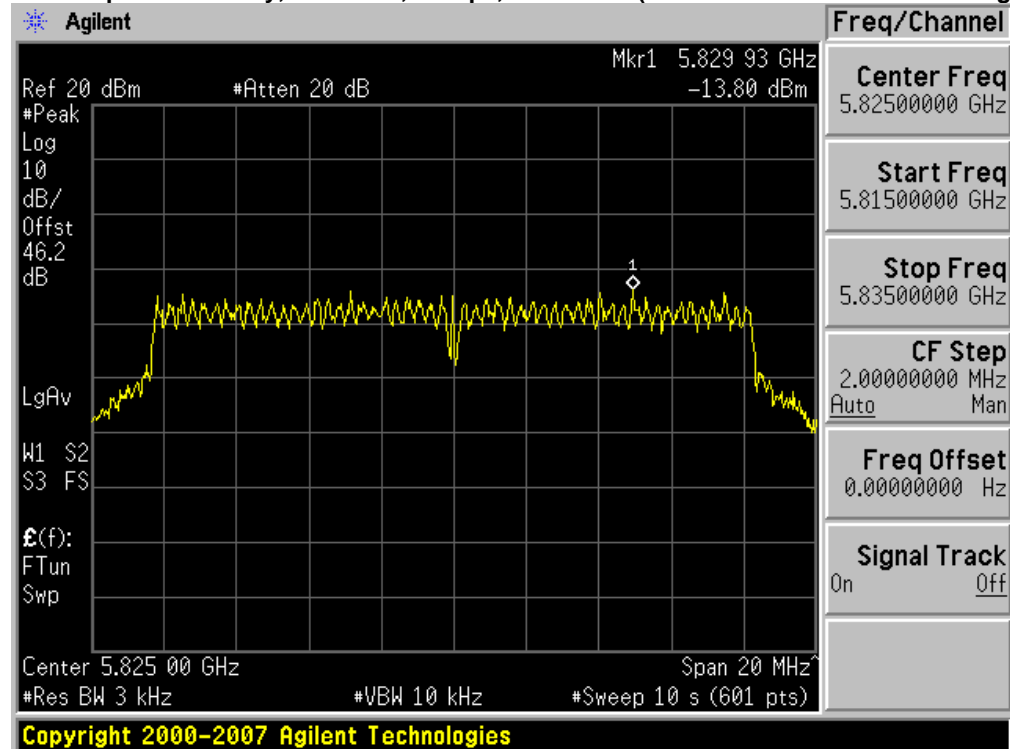


**Power Spectral Density, 5785 MHz, m0, HT20 (with and without Beam Forming / STBC)**

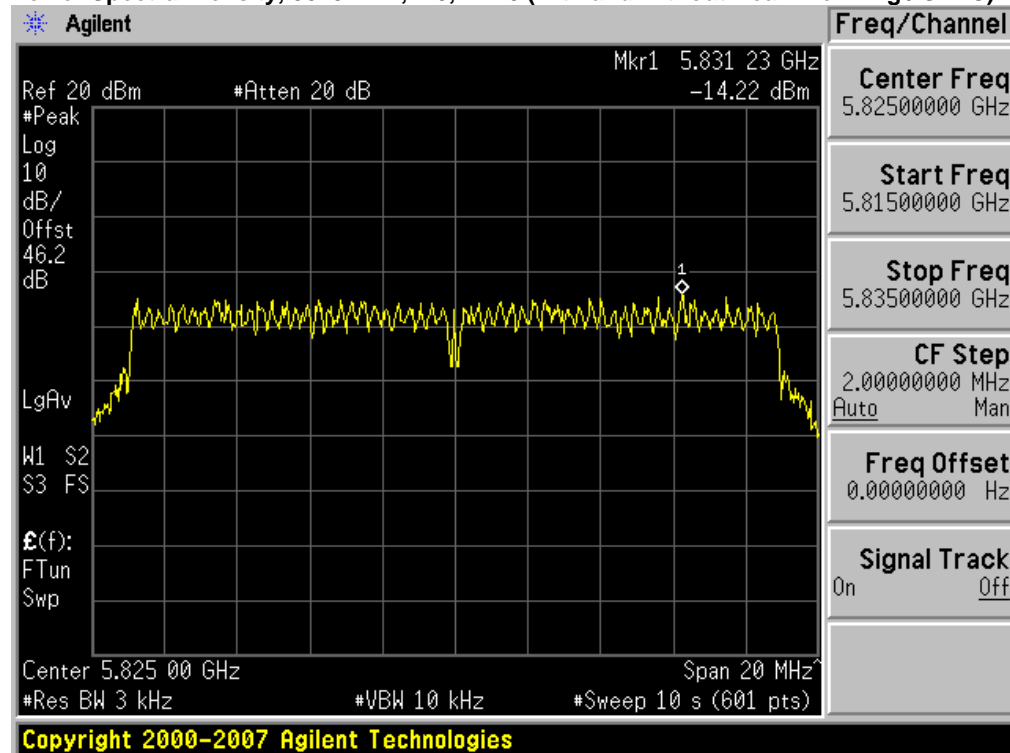




**Power Spectral Density, 5825 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)**



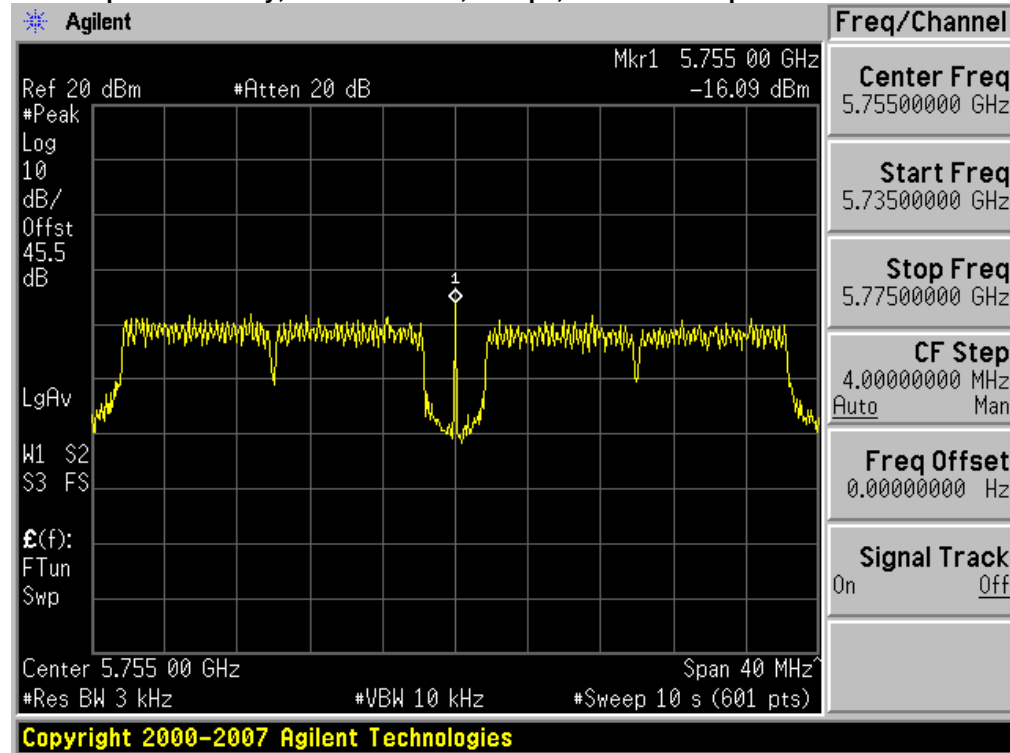
**Power Spectral Density, 5825 MHz, m0, HT20 (with and without Beam Forming / STBC)**



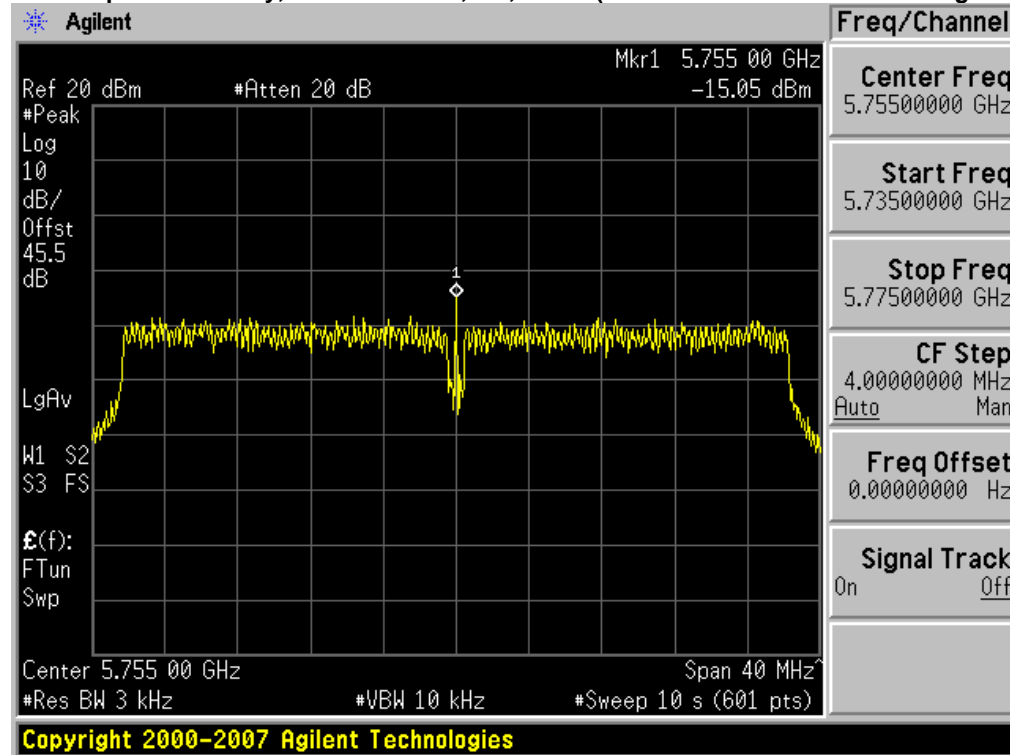




Power Spectral Density, 5745/5765 MHz, 6 Mbps, Non HT-40 Duplicate

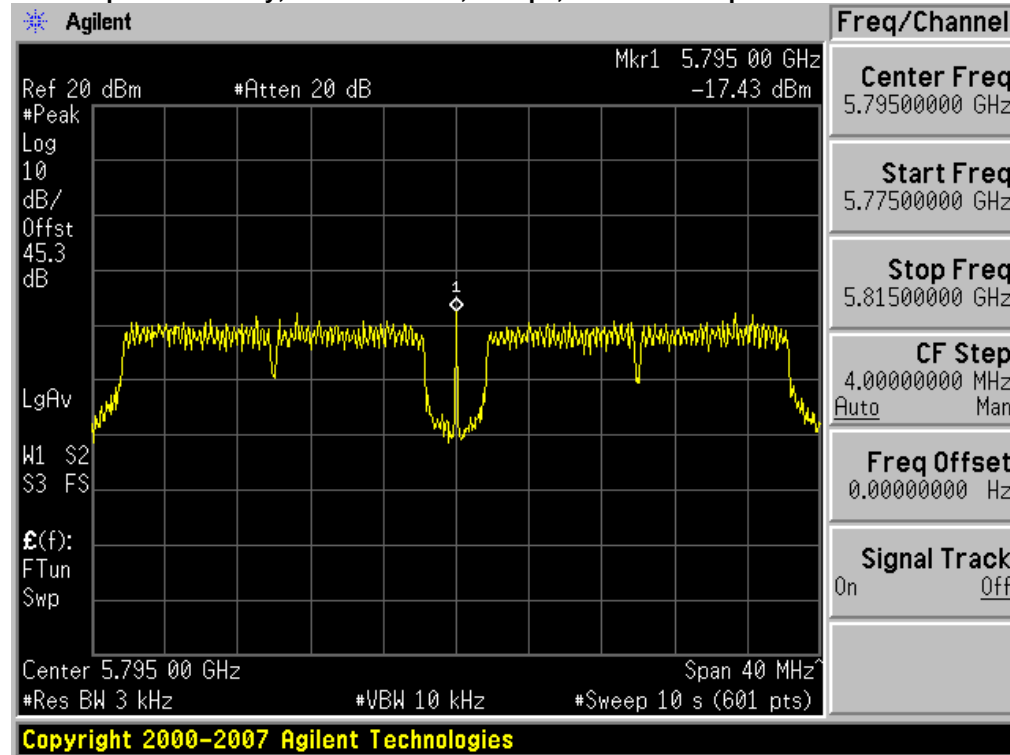


Power Spectral Density, 5745/5765 MHz, m0, HT-40 (with and without Beam Forming / STBC)

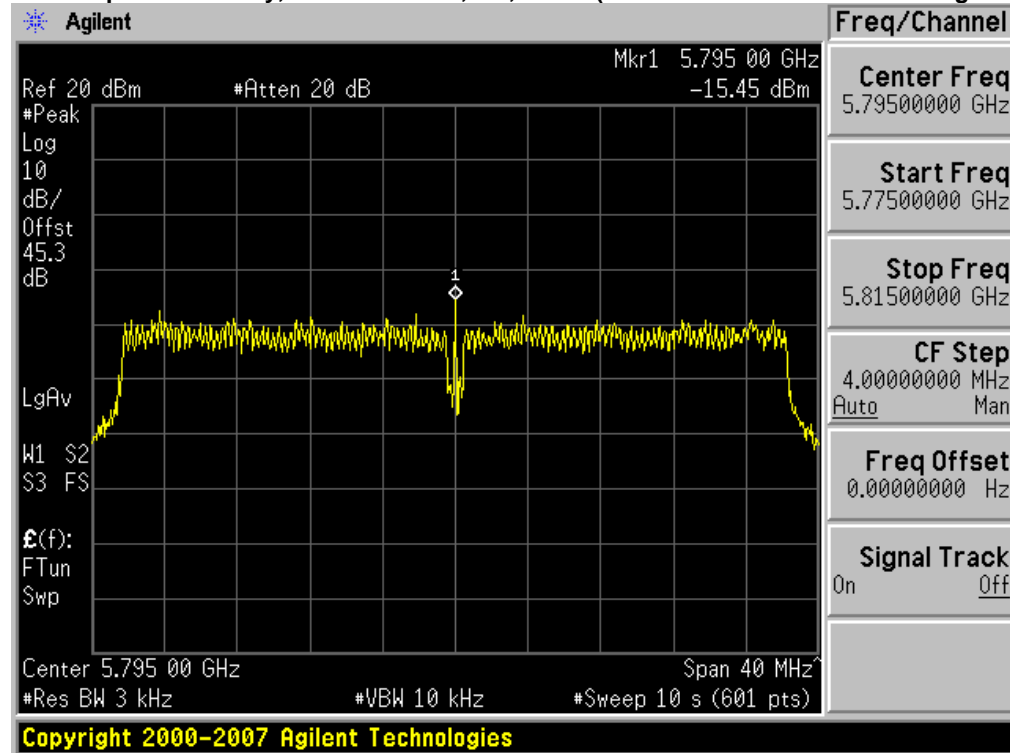




**Power Spectral Density, 5785/5805 MHz, 6 Mbps, Non HT-40 Duplicate**



**Power Spectral Density, 5785/5805 MHz, m0, HT-40 (with and without Beam Forming / STBC)**





## Conducted Spurious Emissions

15.247: 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

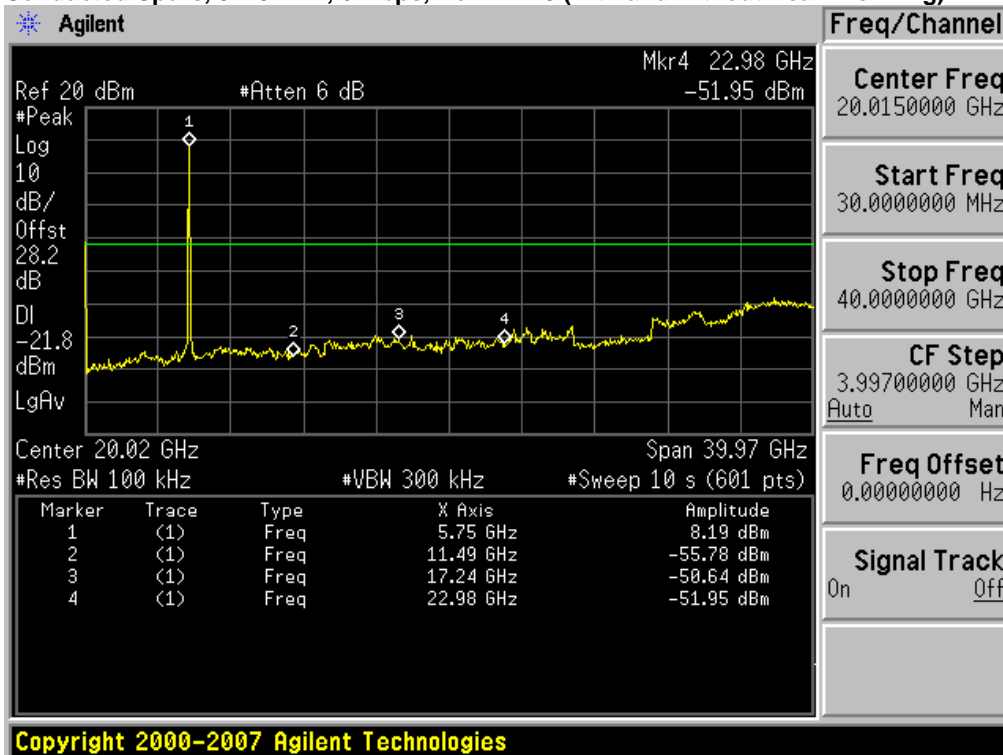
Out-of-band and spurious emissions tests are performed on each output individually without summing or adding  $10 \log(N)$  since the measurements are made relative to the in-band emissions on the individual outputs. The worst case output is recorded.



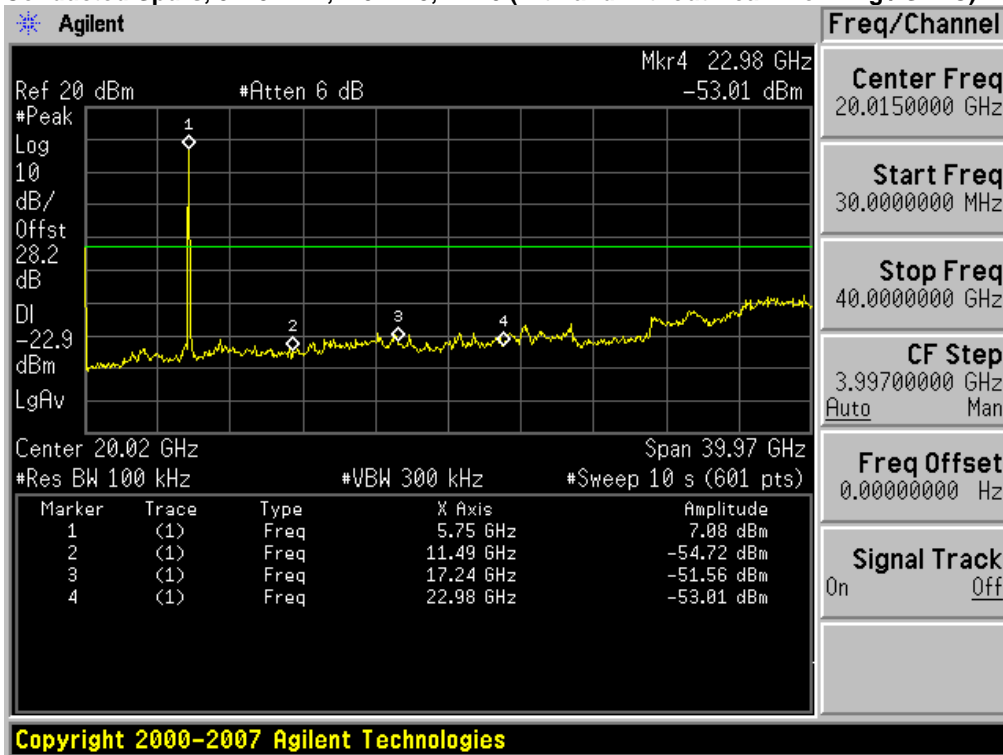
| Frequency (MHz) | Mode                                 | Data Rate (Mbps) | Conducted Spur Delta (dB) | Limit (dBc) | Margin (dB) |
|-----------------|--------------------------------------|------------------|---------------------------|-------------|-------------|
| 5745            | Non HT-20, 6 to 54 Mbps              | 6                | 58.8                      | 30.0        | 28.8        |
|                 | Non HT-20 Beam Forming, 6 to 54 Mbps | 6                | 58.8                      | 30.0        | 28.8        |
|                 | HT-20, M0 to M23                     | m0               | 58.6                      | 30.0        | 28.6        |
|                 | HT-20 STBC, M0 to M7                 | m0               | 58.6                      | 30.0        | 28.6        |
|                 | HT-20 Beam Forming, M0 to M23        | m0               | 58.6                      | 30.0        | 28.6        |
| 5785            | Non HT-20, 6 to 54 Mbps              | 6                | 58.4                      | 30.0        | 28.4        |
|                 | Non HT-20 Beam Forming, 6 to 54 Mbps | 6                | 58.4                      | 30.0        | 28.4        |
|                 | HT-20, M0 to M23                     | m0               | 57.6                      | 30.0        | 27.6        |
|                 | HT-20 STBC, M0 to M7                 | m0               | 57.6                      | 30.0        | 27.6        |
|                 | HT-20 Beam Forming, M0 to M23        | m0               | 57.6                      | 30.0        | 27.6        |
| 5805            | Non HT-20, 6 to 54 Mbps              | 6                | 57.9                      | 30.0        | 27.9        |
|                 | Non HT-20 Beam Forming, 6 to 54 Mbps | 6                | 57.9                      | 30.0        | 27.9        |
|                 | HT-20, M0 to M23                     | m0               | 57.1                      | 30.0        | 27.1        |
|                 | HT-20 STBC, M0 to M7                 | m0               | 57.1                      | 30.0        | 27.1        |
|                 | HT-20 Beam Forming, M0 to M23        | m0               | 57.1                      | 30.0        | 27.1        |
| 5745/5765       | Non HT-40 Duplicate, 6-54 Mbps       | 6                | 55.8                      | 30.0        | 25.8        |
|                 | HT-40, M0 to M23                     | m0               | 59.1                      | 30.0        | 29.1        |
|                 | HT-40 STBC, M0 to M7                 | m0               | 59.1                      | 30.0        | 29.1        |
|                 | HT-40 Beam Forming, M0 to M23        | m0               | 59.1                      | 30.0        | 29.1        |
| 5785/5805       | Non HT-40 Duplicate, 6-54 Mbps       | 6                | 56.9                      | 30.0        | 26.9        |
|                 | HT-40, M0 to M23                     | m0               | 56.1                      | 30.0        | 26.1        |
|                 | HT-40 STBC, M0 to M7                 | m0               | 56.1                      | 30.0        | 26.1        |
|                 | HT-40 Beam Forming, M0 to M23        | m0               | 56.1                      | 30.0        | 26.1        |



**Conducted Spurs, 5745 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)**

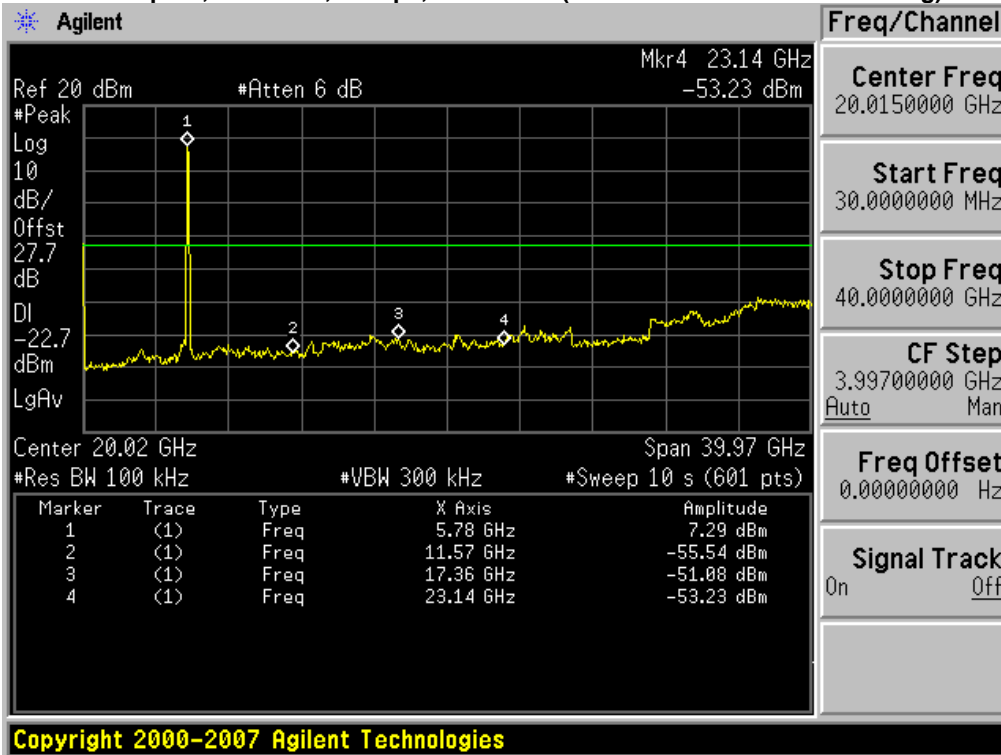


**Conducted Spurs, 5745 MHz, m0-m23, HT20 (with and without Beam Forming / STBC)**

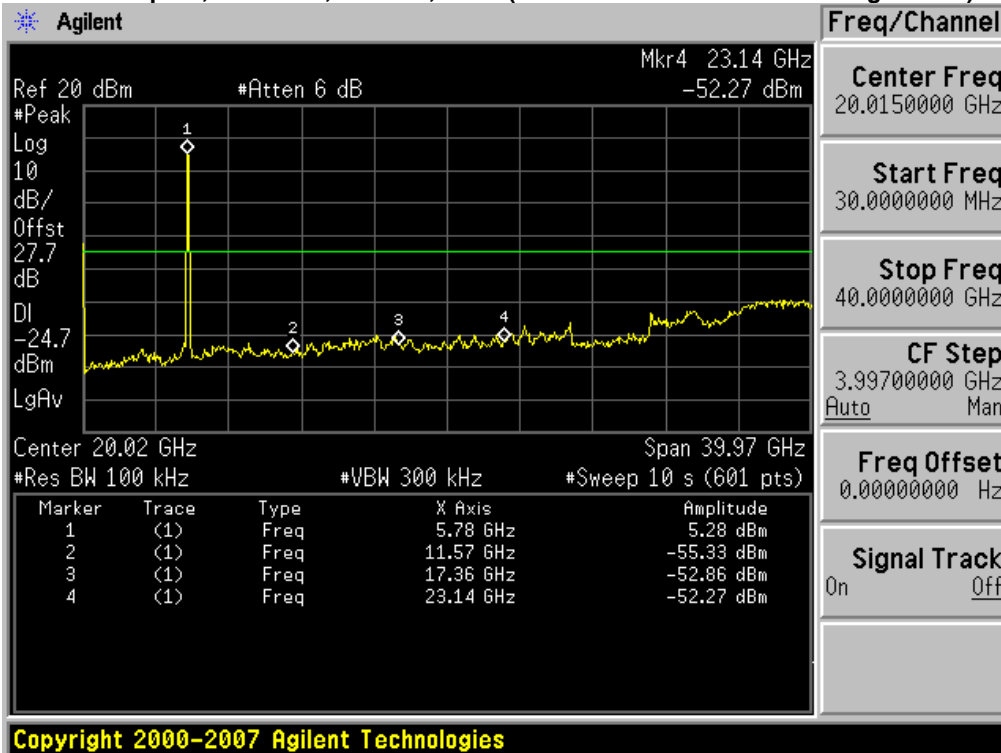




**Conducted Spurs, 5785 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)**

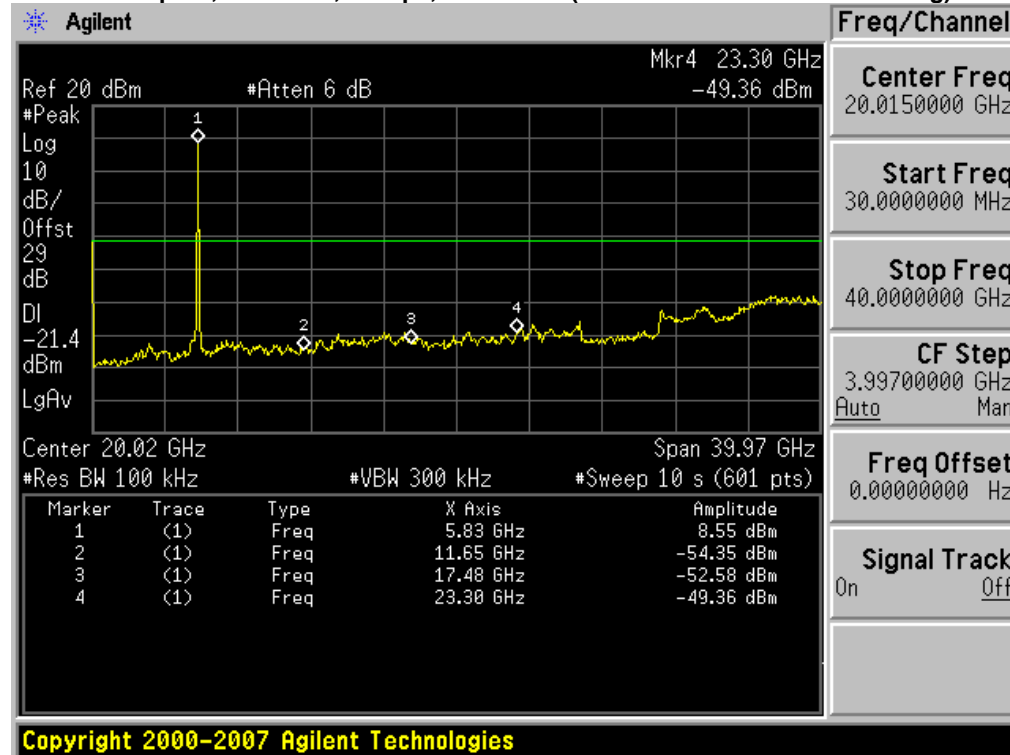


**Conducted Spurs, 5785 MHz, m0-m23, HT20 (with and without Beam Forming / STBC)**

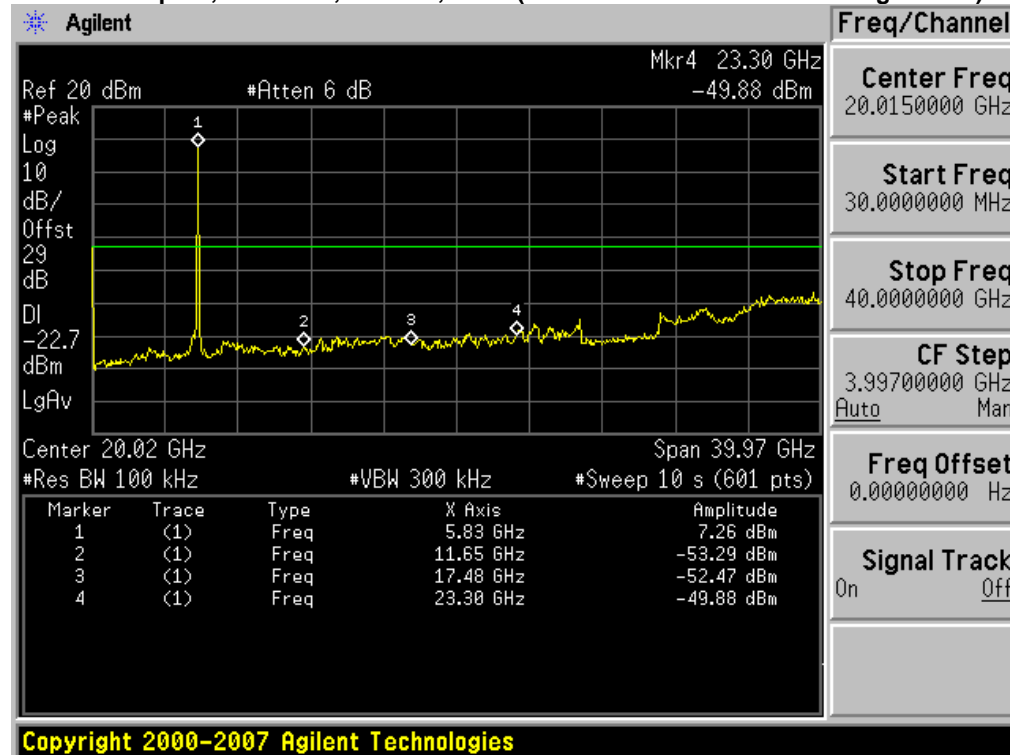




**Conducted Spurs, 5825 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)**

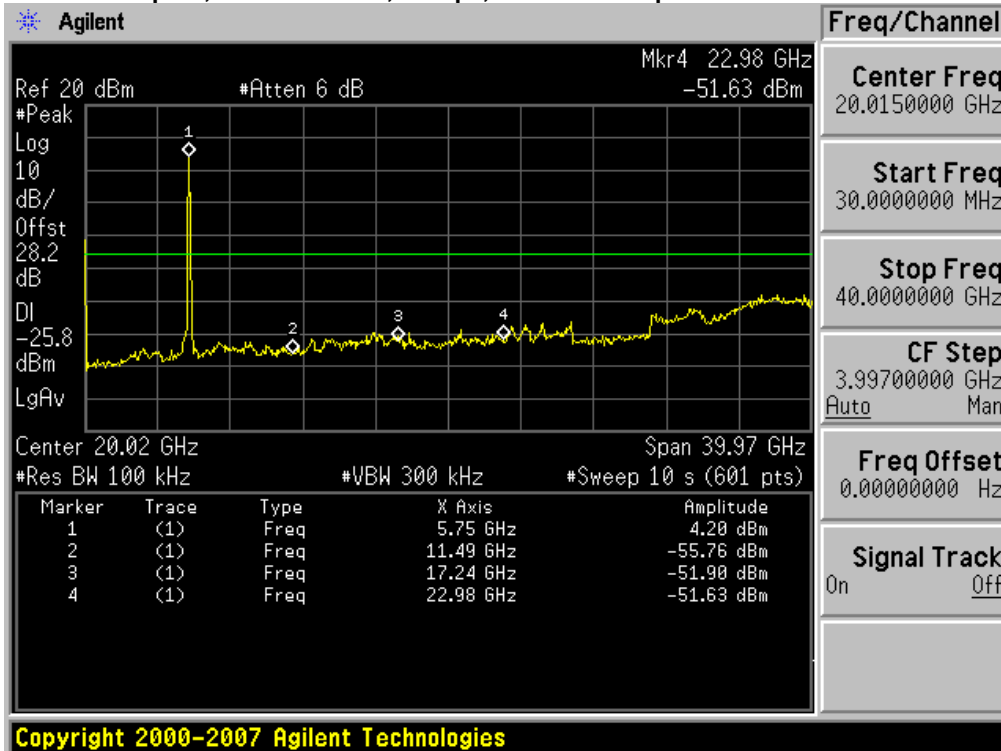


**Conducted Spurs, 5825 MHz, m0-m23, HT20 (with and without Beam Forming / STBC)**

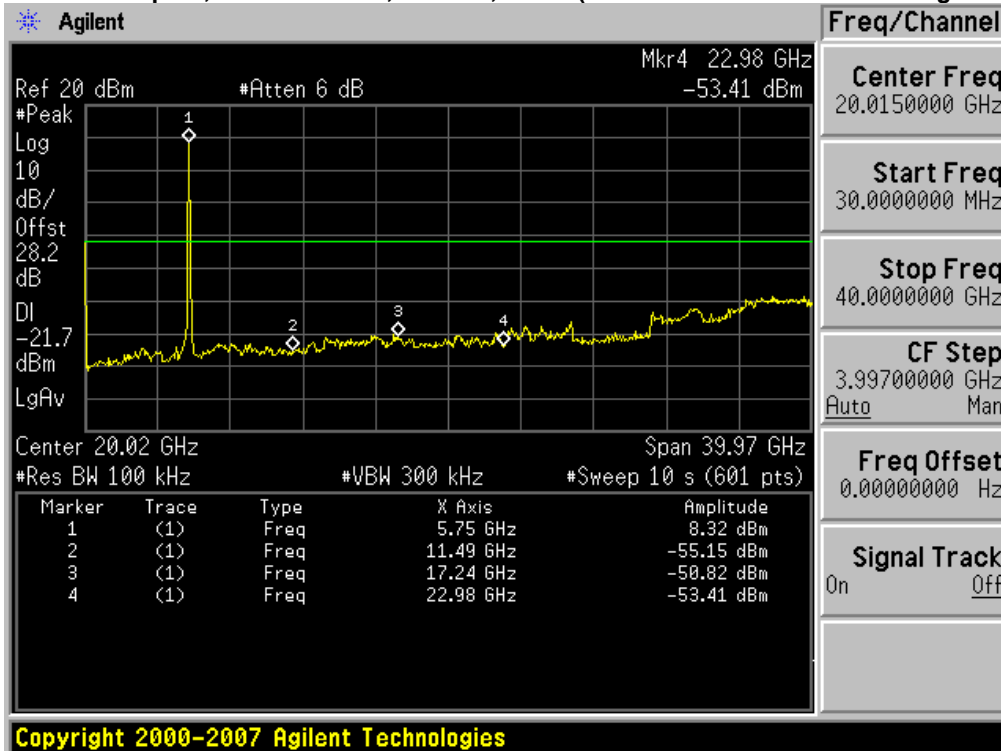




**Conducted Spurs, 5745/5765 MHz, 6 Mbps, Non HT-40 Duplicate**



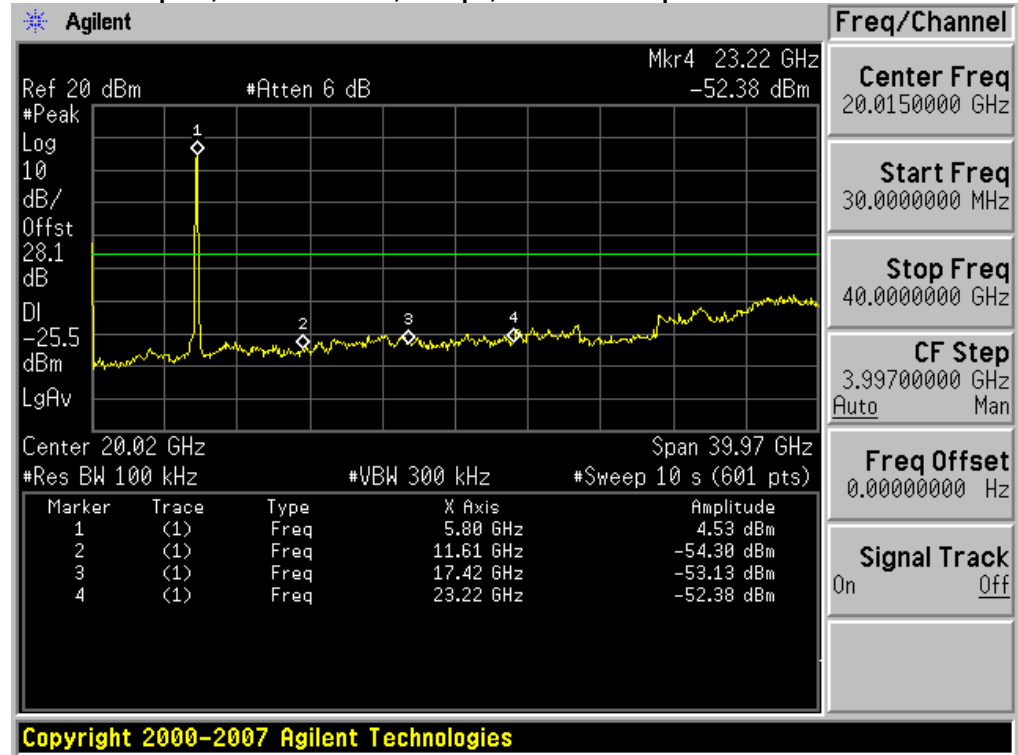
**Conducted Spurs, 5745/5765 MHz, m0-m23, HT-40 (with and without Beam Forming / STBC)**



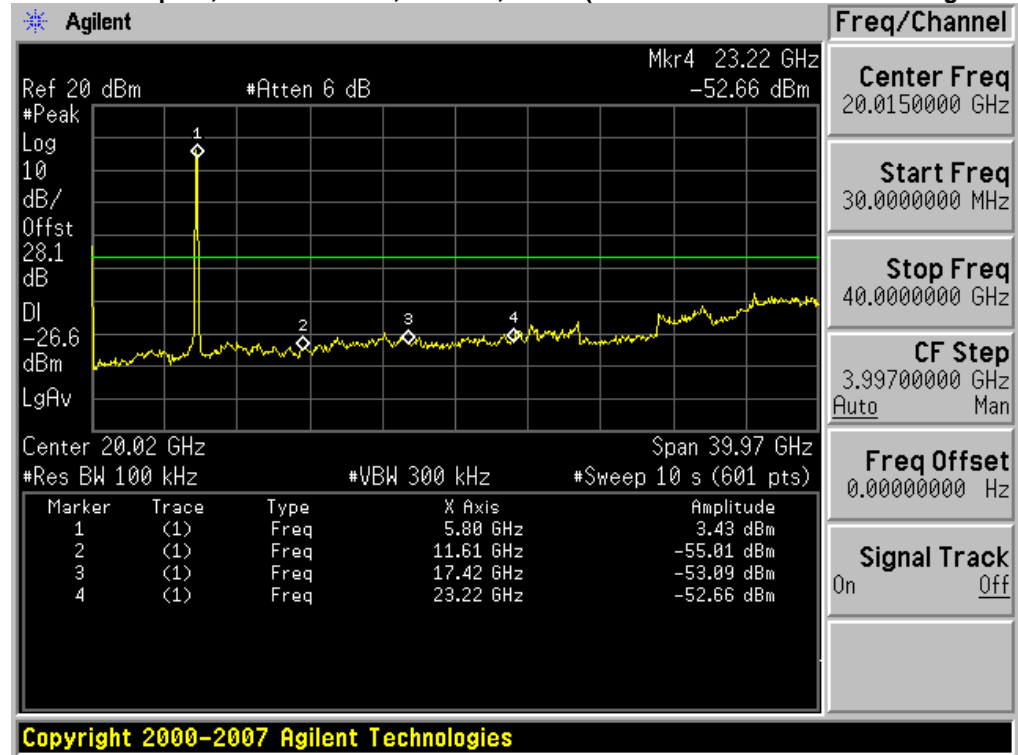




**Conducted Spurs, 5785/5805 MHz, 6 Mbps, Non HT-40 Duplicate**



**Conducted Spurs, 5785/5805 MHz, m0-m23, HT-40 (with and without Beam Forming / STBC)**





## Conducted Bandedge

15.247: 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

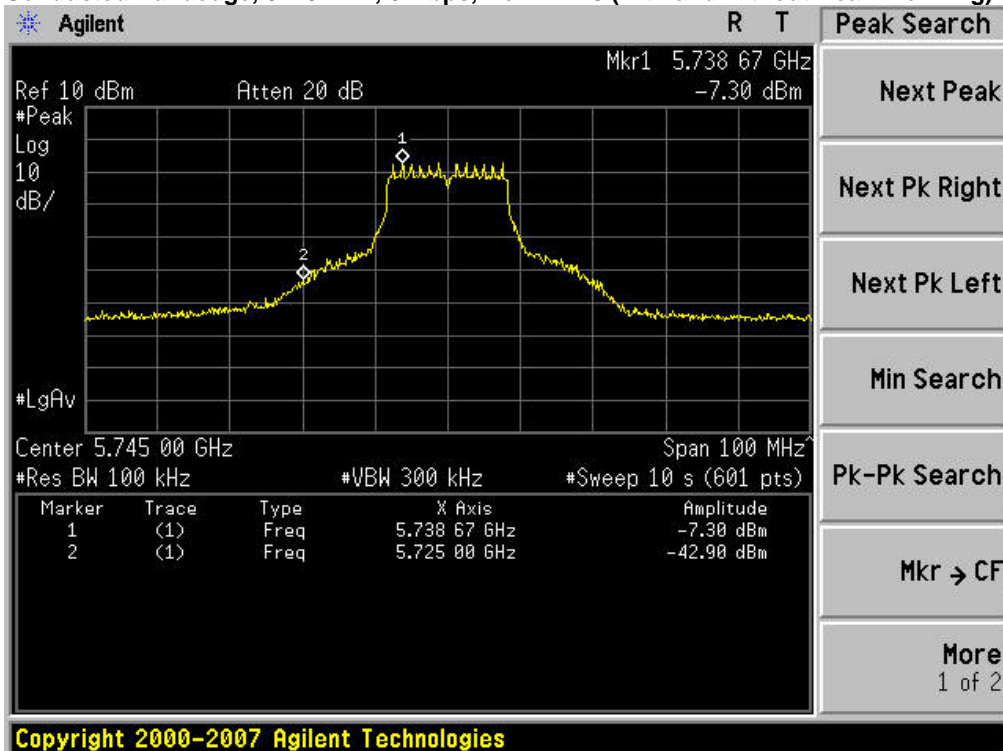
Out-of-band and spurious emissions tests are performed on each output individually without summing or adding  $10 \log(N)$  since the measurements are made relative to the in-band emissions on the individual outputs. The worst case output is recorded.



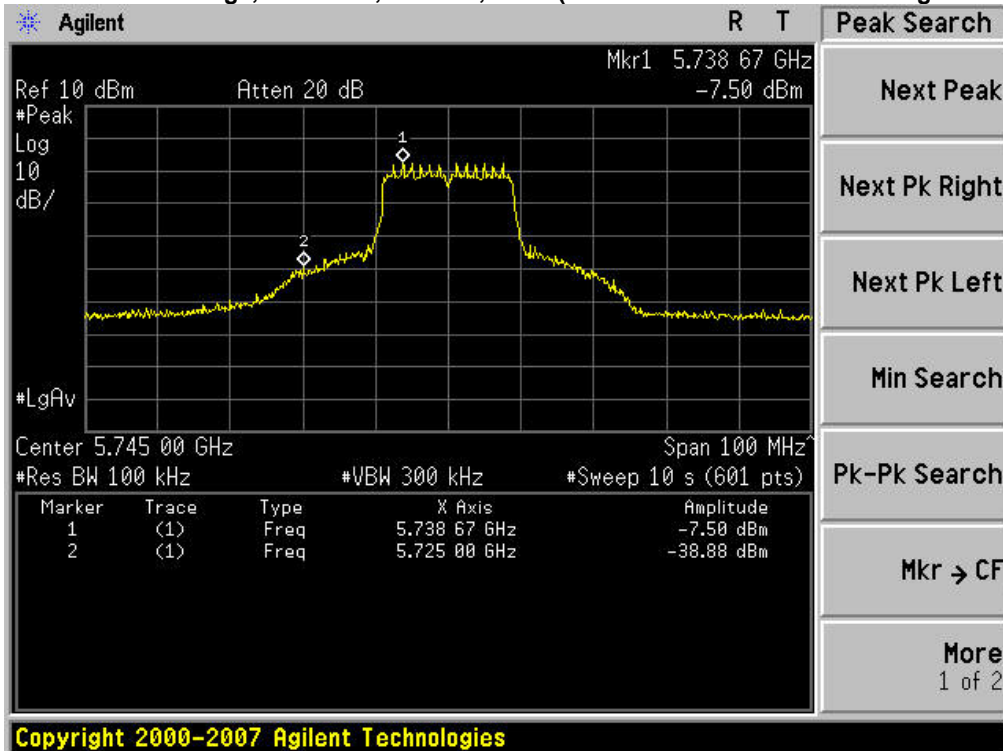
| Frequency (MHz) | Operating Mode                       | Tx Paths | Conducted Spur Delta (dB) | Limit (dBc) | Margin (dB) |
|-----------------|--------------------------------------|----------|---------------------------|-------------|-------------|
| 5745            | Non HT-20, 6 to 54 Mbps              | 4        | 35.6                      | >30         | 5.6         |
|                 | Non HT-20 Beam Forming, 6 to 54 Mbps | 4        | 35.6                      | >30         | 5.6         |
|                 | HT-20, M0 to M23                     | 4        | 31.4                      | >30         | 1.4         |
|                 | HT-20 STBC, M0 to M7                 | 4        | 31.4                      | >30         | 1.4         |
|                 | HT-20 Beam Forming, M0 to M7         | 4        | 31.4                      | >30         | 1.4         |
|                 | HT-20 Beam Forming, M8 to M15        | 4        | 31.4                      | >30         | 1.4         |
|                 | HT-20 Beam Forming, M16 to M23       | 4        | 31.4                      | >30         | 1.4         |
| 5825            | Non HT-20, 6 to 54 Mbps              | 4        | 46.9                      | >30         | 16.9        |
|                 | Non HT-20 Beam Forming, 6 to 54 Mbps | 4        | 46.9                      | >30         | 16.9        |
|                 | HT-20, M0 to M23                     | 4        | 43.8                      | >30         | 13.8        |
|                 | HT-20 STBC, M0 to M7                 | 4        | 43.8                      | >30         | 13.8        |
|                 | HT-20 Beam Forming, M0 to M7         | 4        | 43.8                      | >30         | 13.8        |
|                 | HT-20 Beam Forming, M8 to M15        | 4        | 43.8                      | >30         | 13.8        |
|                 | HT-20 Beam Forming, M16 to M23       | 4        | 43.8                      | >30         | 13.8        |
| 5745/5765       | Non HT-40 Duplicate, 6-54 Mbps       | 4        | 31.6                      | >30         | 1.6         |
|                 | HT-40, M0 to M23                     | 4        | 31.6                      | >30         | 1.6         |
|                 | HT-40 STBC, M0 to M7                 | 4        | 31.6                      | >30         | 1.6         |
|                 | HT-40 Beam Forming, M0 to M7         | 4        | 31.6                      | >30         | 1.6         |
|                 | HT-40 Beam Forming, M8 to M15        | 4        | 31.6                      | >30         | 1.6         |
|                 | HT-40 Beam Forming, M16 to M23       | 4        | 31.6                      | >30         | 1.6         |
| 5785/5805       | Non HT-40 Duplicate, 6-54 Mbps       | 4        | 44.2                      | >30         | 14.2        |
|                 | HT-40, M0 to M23                     | 4        | 44.2                      | >30         | 14.2        |
|                 | HT-40 STBC, M0 to M7                 | 4        | 44.2                      | >30         | 14.2        |
|                 | HT-40 Beam Forming, M0 to M7         | 4        | 44.2                      | >30         | 14.2        |
|                 | HT-40 Beam Forming, M8 to M15        | 4        | 44.2                      | >30         | 14.2        |
|                 | HT-40 Beam Forming, M16 to M23       | 4        | 44.2                      | >30         | 14.2        |



**Conducted Bandedge, 5745 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)**

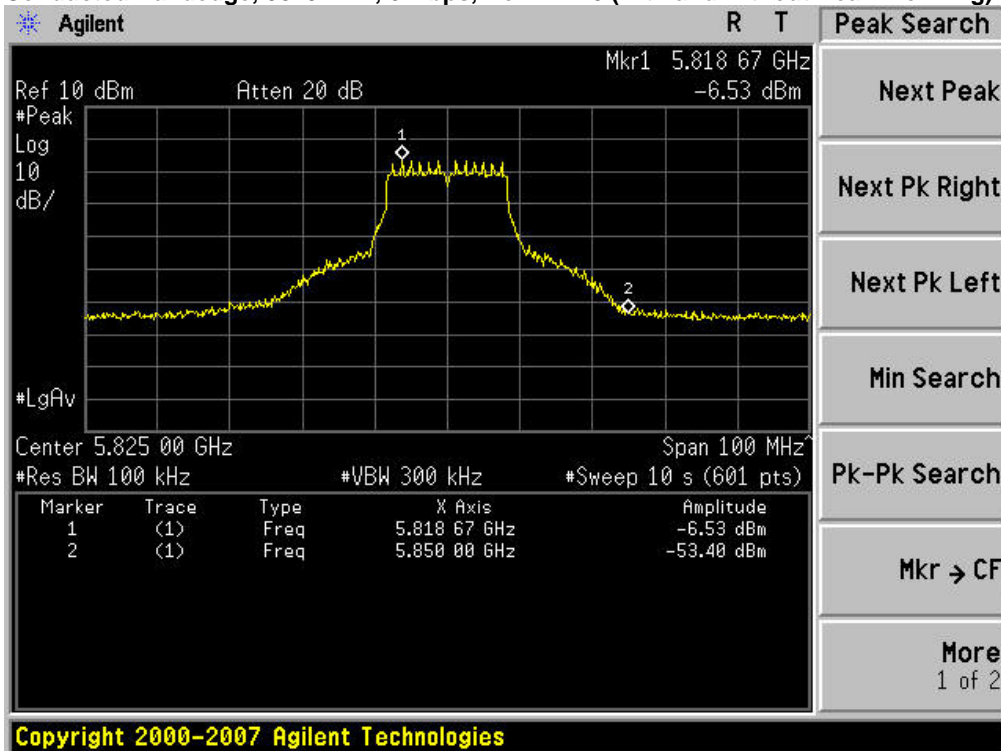


**Conducted Bandedge, 5745 MHz, m0-m23, HT20 (with and without Beam Forming / STBC)**

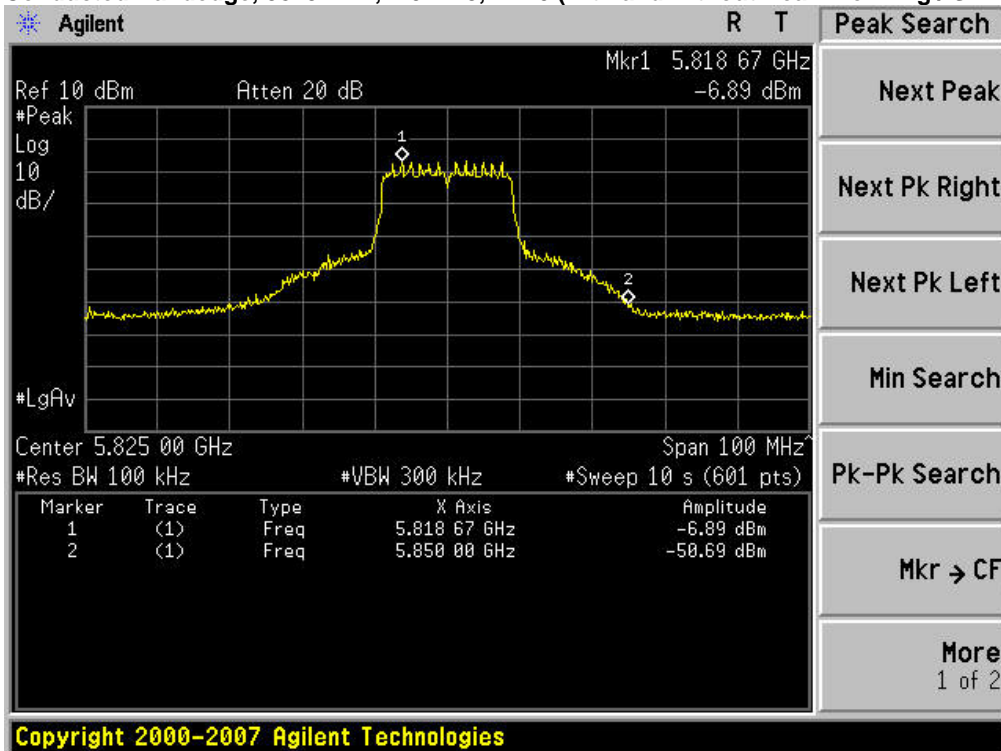




**Conducted Bandedge, 5825 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)**

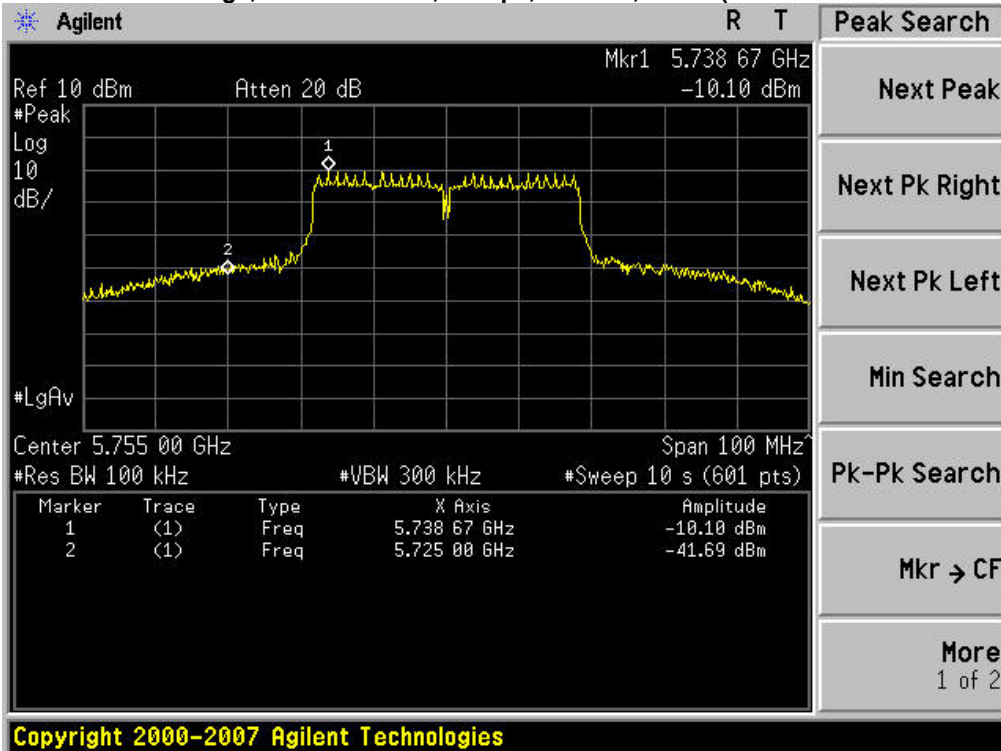


**Conducted Bandedge, 5825 MHz, m0-m23, HT20 (with and without Beam Forming / STBC)**



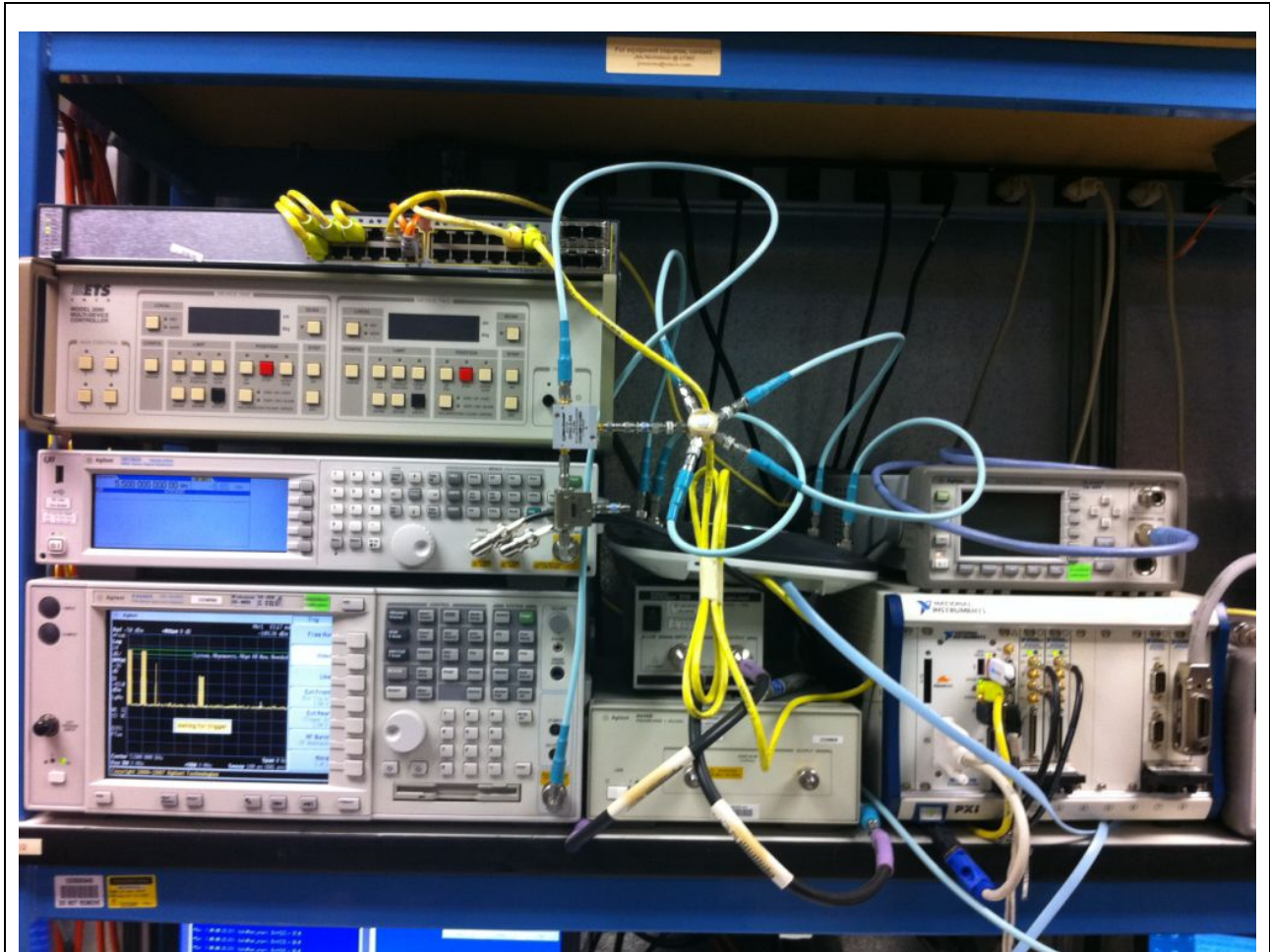


**Conducted Bandedge, 5745/5765 MHz, 6 Mbps, m0-m23, HT-40 (with and without Beam Forming / STBC)**



**Conducted Bandedge, 5785/5805 MHz, 6Mbps, m0-m23, HT-40 (with and without Beam Forming / STBC)**





**Title:** Conducted Test Setup



**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.

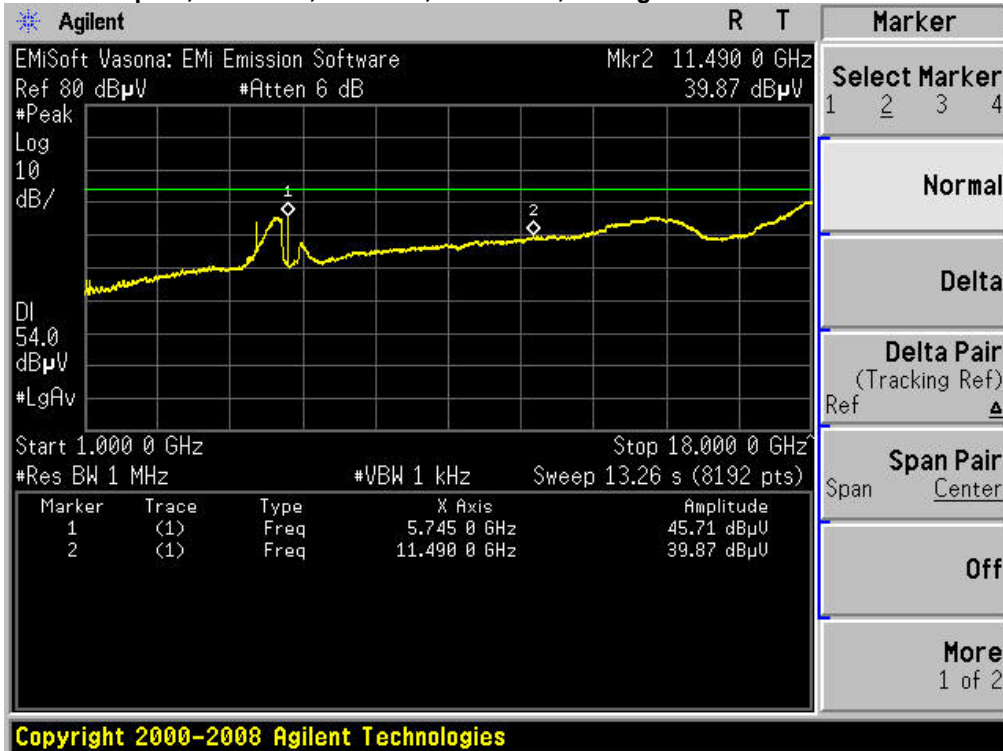
This report represents the worst case data for all supported operating modes and antennas. There are no measurable emissions above 18 GHz.

| Frequency (MHz) | Mode | Data Rate (Mbps) | Spurious Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|------|------------------|----------------------------------|----------------|-------------|
| 5745            | All  | All              | 39.9                             | 54.0           | 14.1        |
| 5785            | All  | All              | 39.4                             | 54.0           | 14.6        |
| 5825            | All  | All              | 40.9                             | 54.0           | 13.1        |

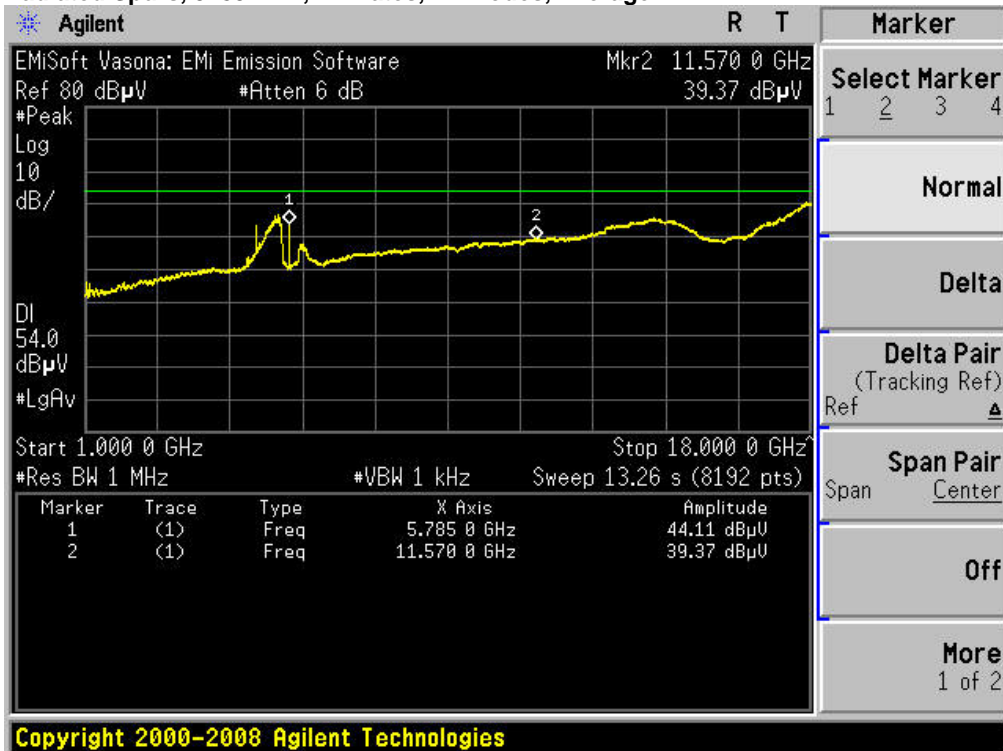




**Radiated Spurs, 5745 MHz, All Rates, All Modes, Average**

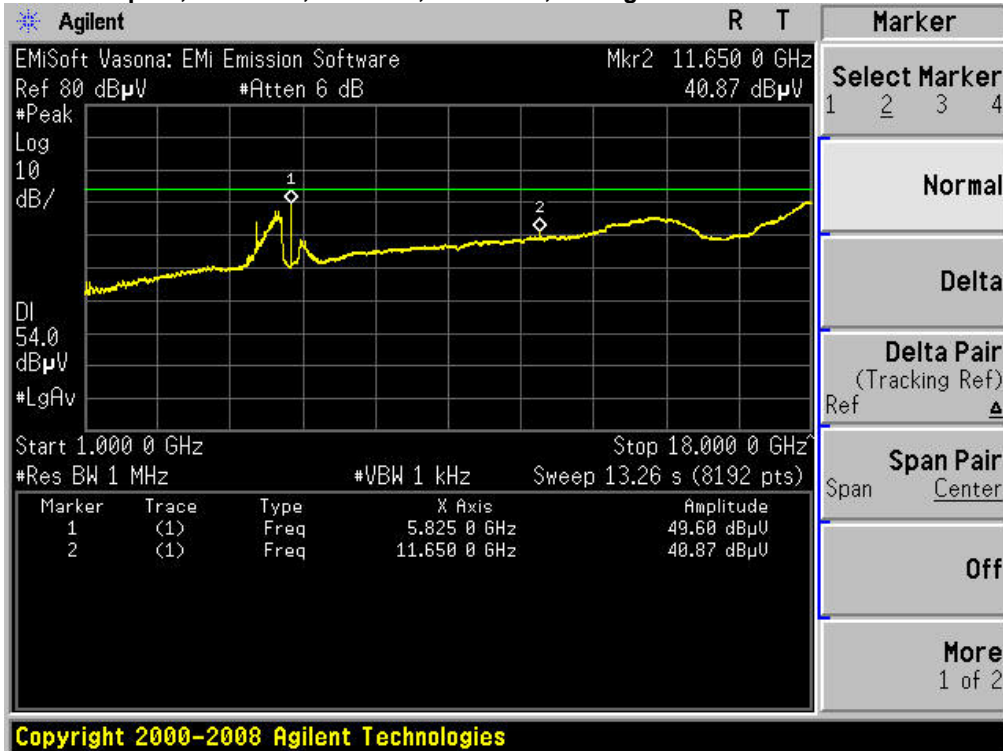


**Radiated Spurs, 5785 MHz, All Rates, All Modes, Average**

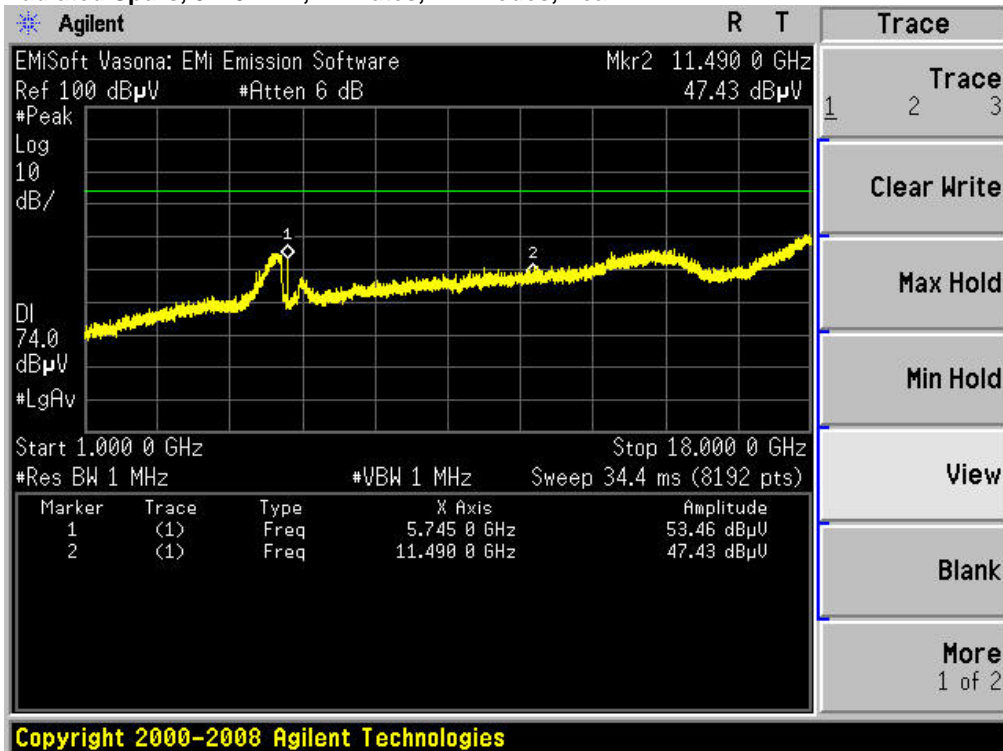




**Radiated Spurs, 5825 MHz, All Rates, All Modes, Average**

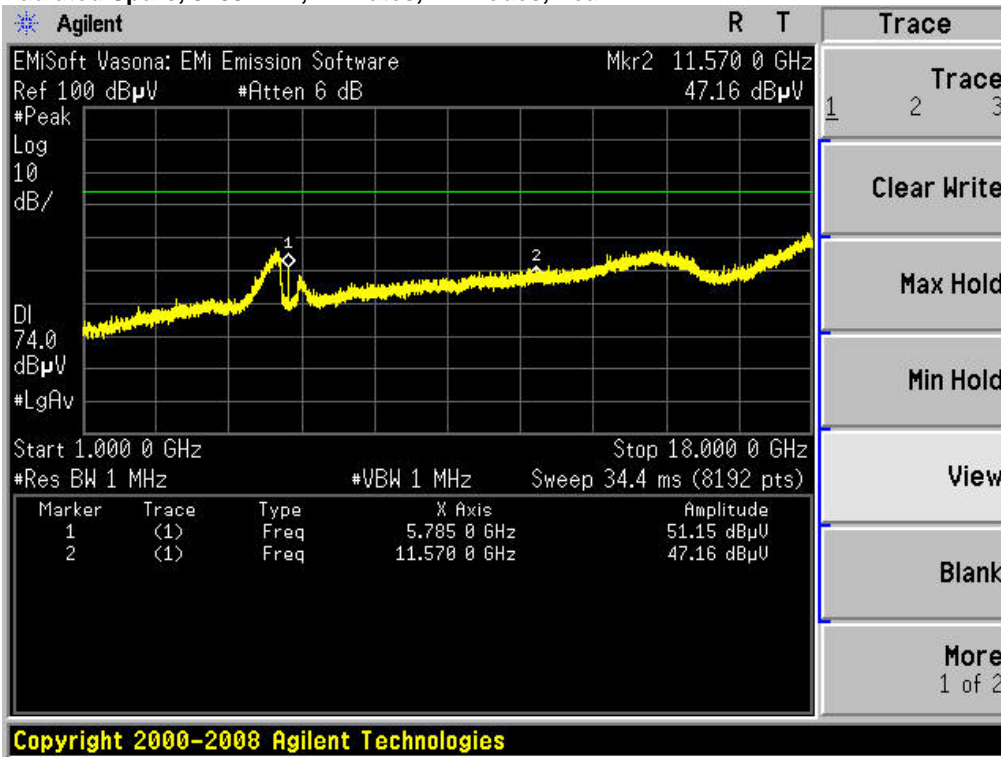


**Radiated Spurs, 5745 MHz, All Rates, All Modes, Peak**

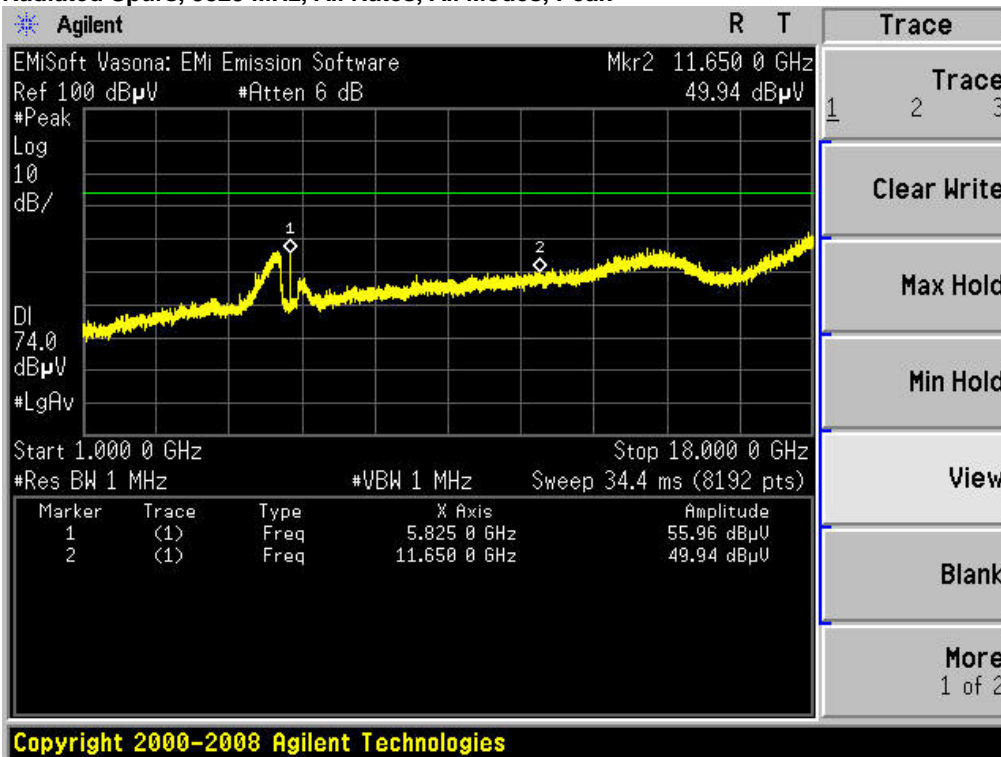




**Radiated Spurs, 5785 MHz, All Rates, All Modes, Peak**

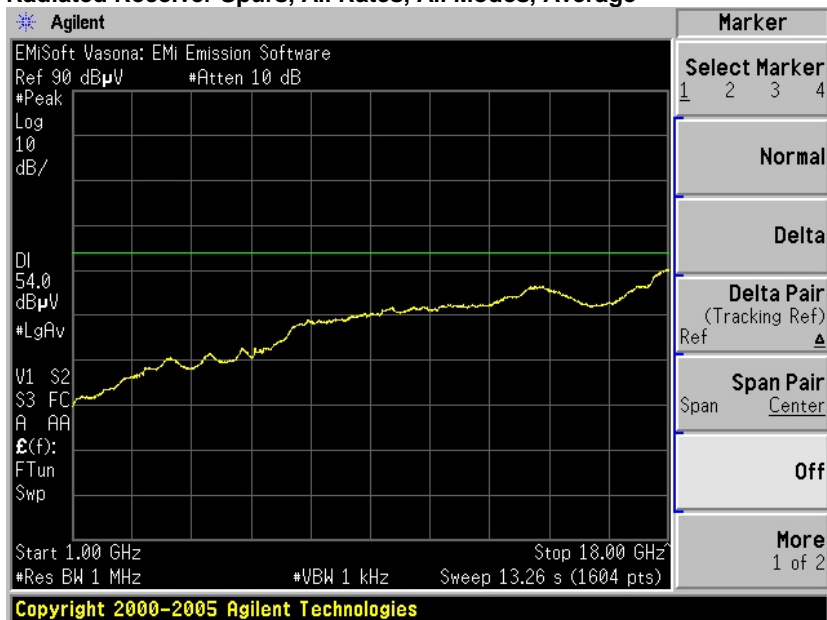


**Radiated Spurs, 5825 MHz, All Rates, All Modes, Peak**

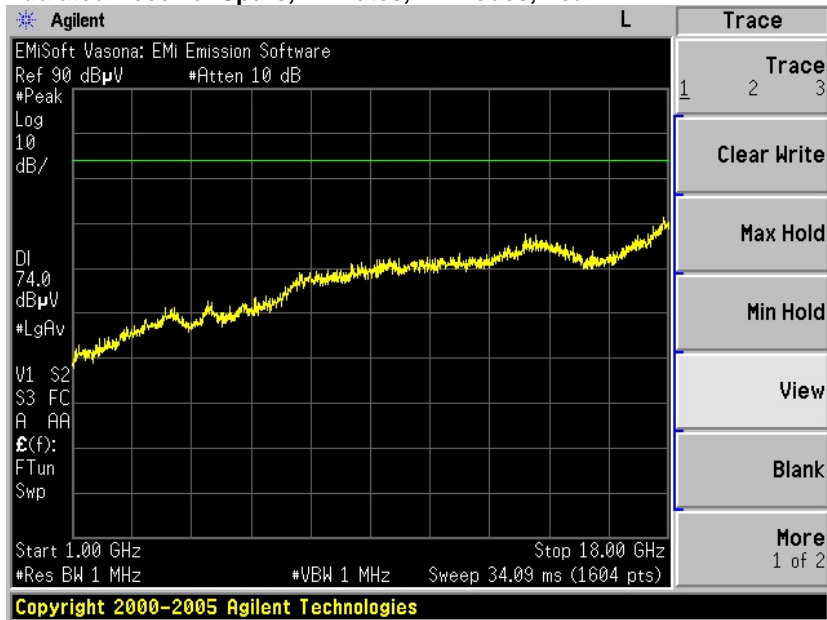




**Radiated Receiver Spurs, All Rates, All Modes, Average**

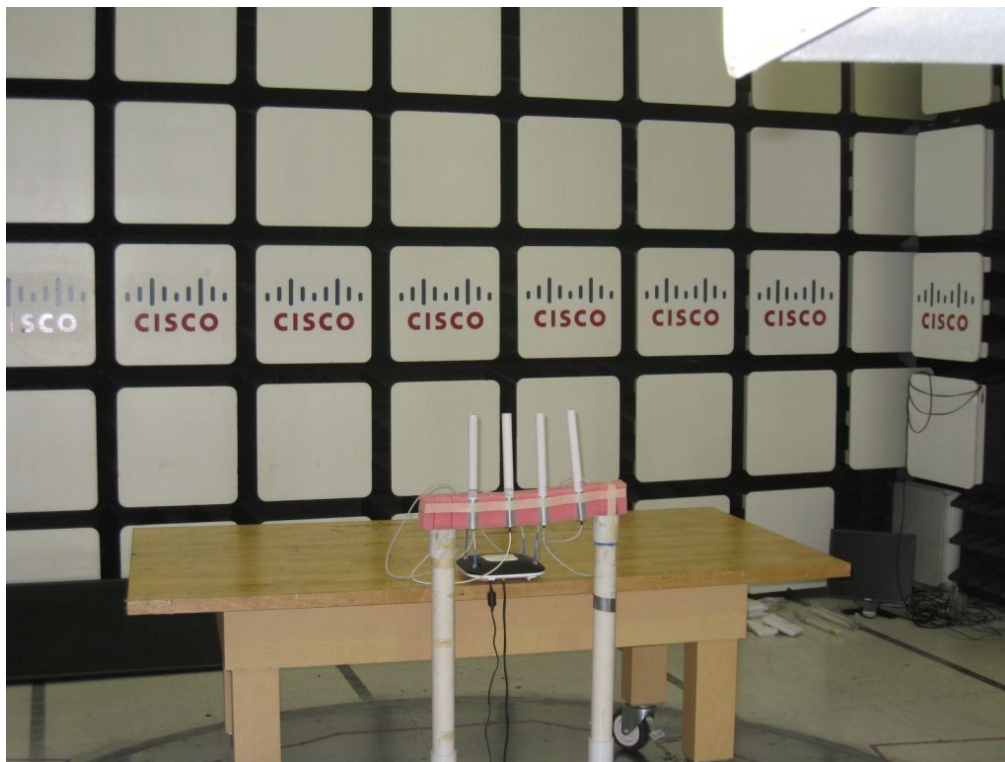


**Radiated Receiver Spurs, All Rates, All Modes, Peak**





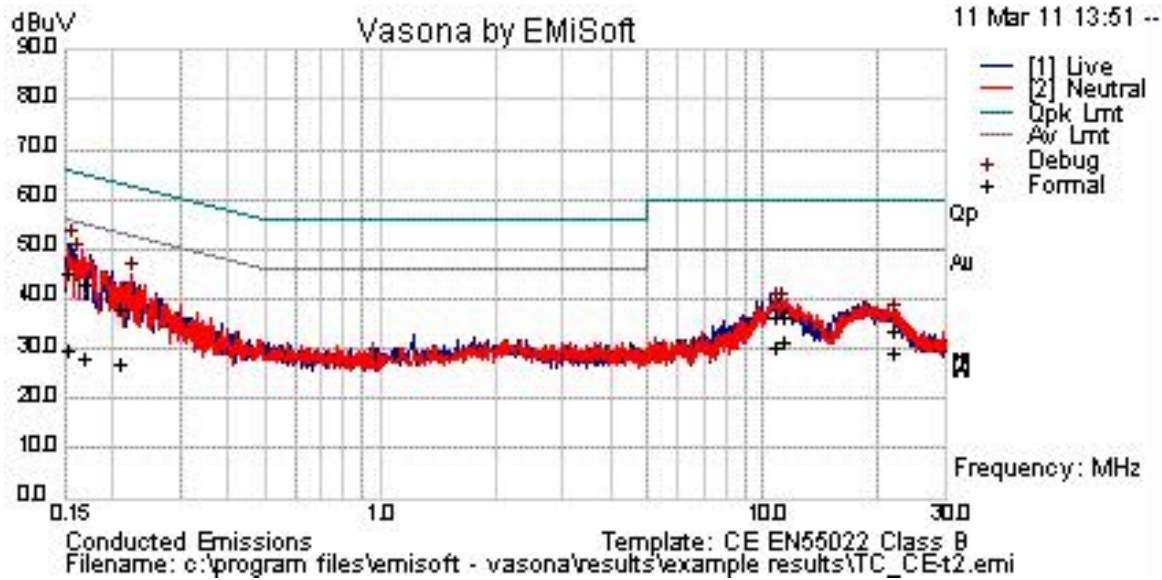
2.4/5 GHz Dual Band 6dBi MIMO patch antenna



5 GHz 6 dBi Omni-directional antennas

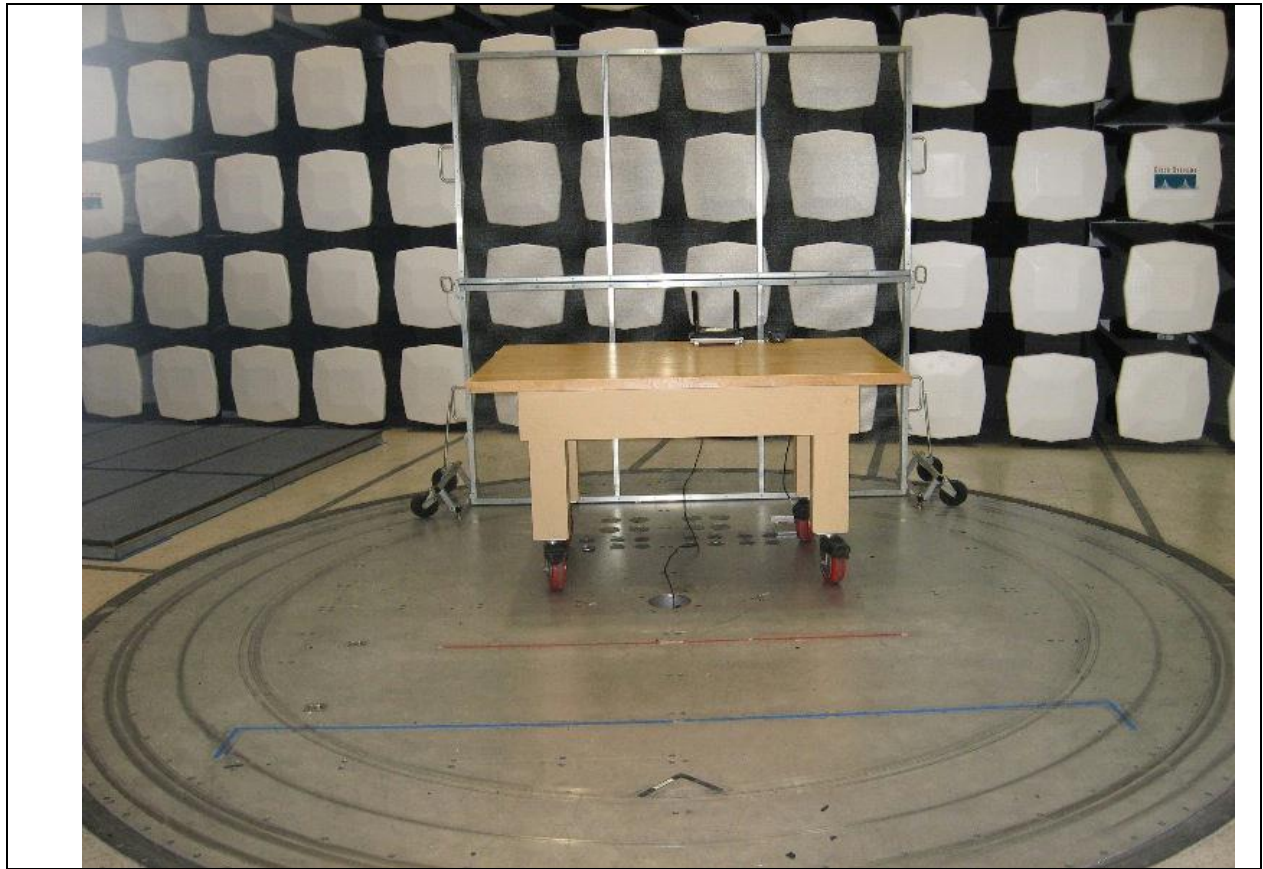


Conducted emissions



Test Results Table

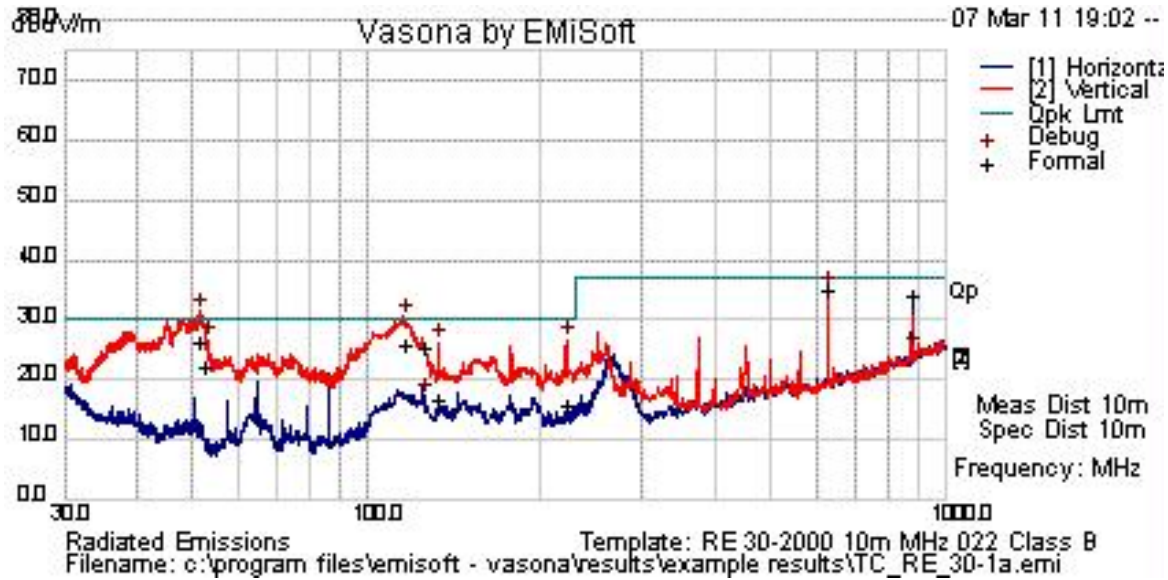
| Frequency MHz | Raw dBuV | Cable Loss | Factors dB | Level dBuV | Measurement Type | Line | Limit dBuV | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|------------|------------|------------------|------|------------|-----------|------------|----------|
| 0.152537      | 6.9      | 21.3       | 1.5        | 29.7       | Av               | L    | 55.9       | -26.2     | Pass       |          |
| 0.152537      | 22.4     | 21.3       | 1.5        | 45.2       | Qp               | L    | 65.9       | -20.7     | Pass       |          |
| 0.167567      | 6.5      | 20.4       | 1.3        | 28.2       | Av               | L    | 55.1       | -26.9     | Pass       |          |
| 0.167567      | 21.4     | 20.4       | 1.3        | 43.1       | Qp               | L    | 65.1       | -22       | Pass       |          |
| 0.207367      | 16.8     | 20.2       | 1          | 38         | Qp               | N    | 63.3       | -25.3     | Pass       |          |
| 0.207367      | 6        | 20.2       | 1          | 27.2       | Av               | N    | 53.3       | -26.1     | Pass       |          |
| 10.834        | 15       | 21.1       | 0.3        | 36.4       | Qp               | N    | 60         | -23.6     | Pass       |          |
| 10.834        | 9.1      | 21.1       | 0.3        | 30.5       | Av               | N    | 50         | -19.5     | Pass       |          |
| 11.215        | 14.8     | 21.1       | 0.3        | 36.3       | Qp               | N    | 60         | -23.7     | Pass       |          |
| 11.215        | 9.9      | 21.1       | 0.3        | 31.3       | Av               | N    | 50         | -18.7     | Pass       |          |
| 22.011        | 6.9      | 21.8       | 0.4        | 29.1       | Av               | N    | 50         | -20.9     | Pass       |          |
| 22.011        | 11.6     | 21.8       | 0.4        | 33.8       | Qp               | N    | 60         | -26.2     | Pass       |          |



**Title:** Conducted Emissions Configuration Photograph



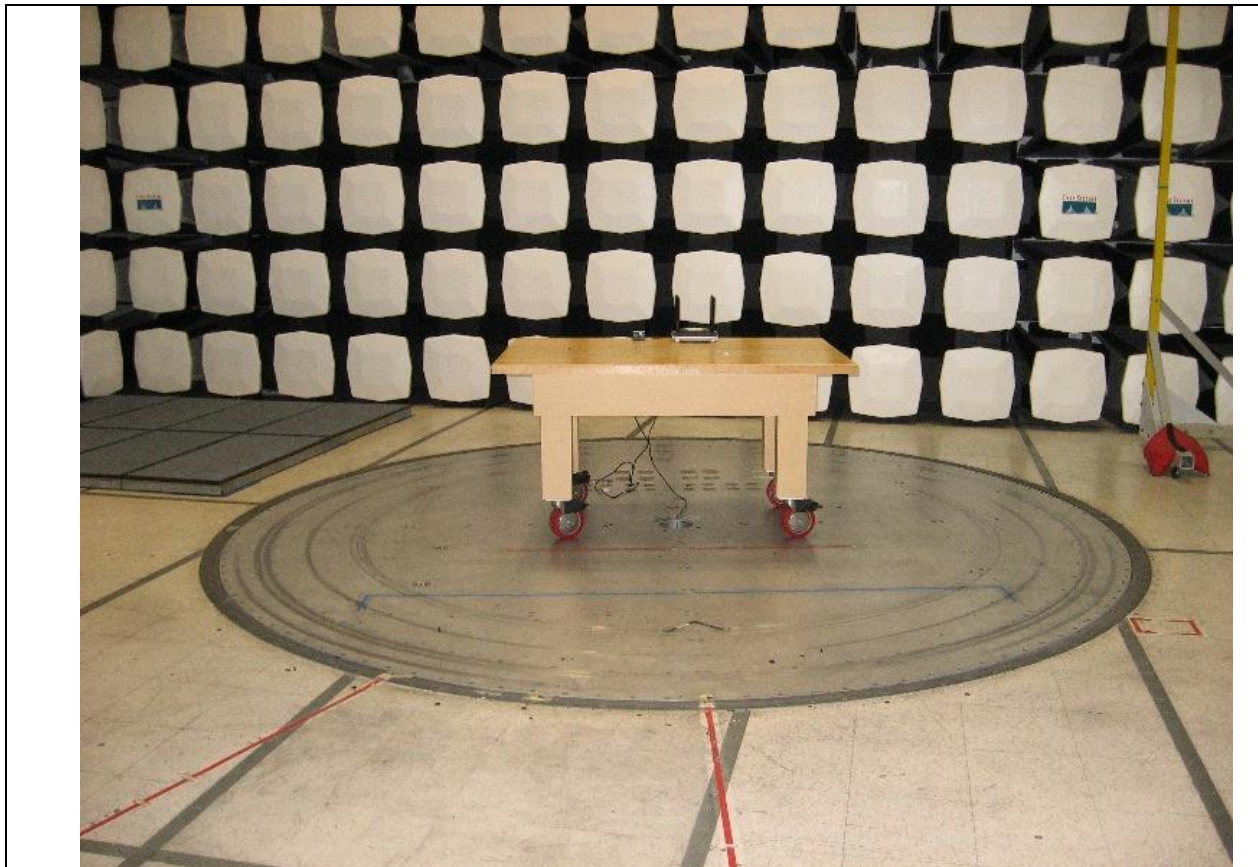
Radiated emissions



Test Results Table

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 51.658        | 52.2     | 1.2        | -24.6 | 28.9         | Qp               | V   | 115    | 174     | 30           | -1.1      | Pass       |          |
| 52.575        | 45.5     | 1.2        | -24.7 | 22           | Qp               | V   | 326    | 173     | 30           | -8        | Pass       |          |
| 115.525       | 43       | 1.4        | -18.6 | 25.8         | Qp               | V   | 253    | 18      | 30           | -4.2      | Pass       |          |
| 124.993       | 42.2     | 1.5        | -18.4 | 25.3         | Qp               | V   | 147    | 155     | 30           | -4.7      | Pass       |          |
| 133.039       | 34.1     | 1.5        | -18.8 | 16.8         | Qp               | V   | 220    | 145     | 30           | -13.2     | Pass       |          |
| 220.884       | 35.4     | 1.7        | -21.5 | 15.7         | Qp               | V   | 247    | 23      | 30           | -14.3     | Pass       |          |
| 625.031       | 46.1     | 2.5        | -13.1 | 35.5         | Qp               | V   | 289    | 77      | 37           | -1.5      | Pass       |          |
| 875.028       | 42.2     | 2.9        | -9.7  | 35.4         | Qp               | H   | 115    | 69      | 37           | -1.6      | Pass       |          |





**Title:** Radiated Emissions Configuration Photograph

## Maximum Permissible Exposure (MPE) Calculations

15.247: 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

$$E = \sqrt{(30 * P * G) / d} \quad \text{and} \quad S = E^2 / 3770$$

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<sup>2</sup>

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

$$d = \sqrt{((30 * P * G) / (3770 * S))}$$

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

$$P(\text{mW}) = P(\text{W}) / 1000 \quad d(\text{cm}) = 100 * d(\text{m})$$

yields

$$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$$

$$d = 0.282 * \sqrt{(P * G / S)}$$

where

d=Distance in cm

P=Power in mW

G=Numerica Antenna Gain

S=Power Density in mW/cm<sup>2</sup>

Substituting the logarithmic form of power and gain using:

$$P(\text{mW}) = 10^{(P(\text{dBm}) / 10)} \quad G(\text{numeric}) = 10^{(G(\text{dBi}) / 10)}$$

yields

$$d = 0.282 * 10^{((P + G) / 20)} / \sqrt{S} \quad \text{Equation (1)}$$

and

$$s = ((0.282 * 10^{((P + G) / 20)}) / d)^2 \quad \text{Equation (2)}$$

where

d=MPE distance in cm

P=Power in dBm

G=Antenna Gain in dBi

S=Power Density in mW/cm<sup>2</sup>



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.

$S=1\text{mW/cm}^2$  maximum. The highest supported antenna gain is 6 dBi (12dBi with beamforming). Using the peak power levels recorded in the test report along with Equation 1 above, the MPE distances are calculated as follows.

| Frequency (MHz) | Bit Rate (Mbps) | Power Density (mW/cm <sup>2</sup> ) | Peak Transmit Power (dBm) | Antenna Gain (dBi) | MPE Distance (cm) | Limit (cm) | Margin (cm) |
|-----------------|-----------------|-------------------------------------|---------------------------|--------------------|-------------------|------------|-------------|
| 2412            | 11              | 1                                   | 23.0                      | 12                 | <b>15.86</b>      | 20         | 4.14        |
| 2437            | 11              | 1                                   | 23.0                      | 12                 | <b>15.86</b>      | 20         | 4.14        |
| 2462            | 11              | 1                                   | 23.0                      | 12                 | <b>15.86</b>      | 20         | 4.14        |
| 2412            | 54              | 1                                   | 23.0                      | 12                 | <b>15.86</b>      | 20         | 4.14        |
| 2437            | 54              | 1                                   | 23.0                      | 12                 | <b>15.86</b>      | 20         | 4.14        |
| 2462            | 54              | 1                                   | 23.0                      | 12                 | <b>15.86</b>      | 20         | 4.14        |

**MPE Calculations**

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) | Bit Rate (Mbps) | MPE Distance (cm) | Peak Transmit Power (dBm) | Antenna Gain (dBi) | Power Density (mW/cm <sup>2</sup> ) | Limit (mW/cm <sup>2</sup> ) | Margin (mW/cm <sup>2</sup> ) |
|-----------------|-----------------|-------------------|---------------------------|--------------------|-------------------------------------|-----------------------------|------------------------------|
| 2412            | 11              | 20                | 23.0                      | 12                 | <b>0.63</b>                         | 1                           | 0.37                         |
| 2437            | 11              | 20                | 23.0                      | 12                 | <b>0.63</b>                         | 1                           | 0.37                         |
| 2462            | 11              | 20                | 23.0                      | 12                 | <b>0.63</b>                         | 1                           | 0.37                         |
| 2412            | 54              | 20                | 23.0                      | 12                 | <b>0.63</b>                         | 1                           | 0.37                         |
| 2437            | 54              | 20                | 23.0                      | 12                 | <b>0.63</b>                         | 1                           | 0.37                         |
| 2462            | 54              | 20                | 23.0                      | 12                 | <b>0.63</b>                         | 1                           | 0.37                         |

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

| Equip #   | Manufacturer      | Model                 | Description                          | Last Cal  | Next Due  |
|-----------|-------------------|-----------------------|--------------------------------------|-----------|-----------|
| CIS004882 | EMC Test Systems  | 3115                  | Double Ridged Guide Horn Antenna     | 4-May-10  | 4-May-11  |
| CIS005691 | Miteq             | NSP1800-25-S1         | Broadband Preamplifier               | 2-Feb-11  | 2-Feb-12  |
| COM000210 | TTE               | H785-150K-50-21378    | Hi Pass Filter - 150KHz cutoff       | 11-Aug-10 | 11-Aug-11 |
| COM000214 | Fischer           | FCC-LISN-50-50-2M     | Turntable LISN (150KHz-30MHz)        | 5-Mar-11  | 4-Mar-12  |
| CIS021117 | Micro-Coax        | UFB311A-0-2484-520520 | RF Coaxial Cable, to 18GHz, 248.4 in | 24-Aug-10 | 24-Aug-11 |
| CIS030564 | Micro-Coax        | UFB311A-1-0950-504504 | RF Coaxial Cable, to 18GHz, 95 in    | 24-Aug-10 | 24-Aug-11 |
| CIS044005 | MegaPhase         | EM18-NKNK-320         | RF N Type Cable 18GHz                | 24-Aug-10 | 24-Aug-11 |
| COM000233 | Sunol Sciences    | JB1                   | Combination Antenna, 30MHz-2GHz      | 19-Jul-10 | 19-Jul-11 |
| CIS037227 | Micro-Tronics     | BRC50705              | Notch Filter, SB:5.725-5.875GHz      | 7-Jul-10  | 7-Jul-11  |
| CIS034972 | Midwest Microwave | ATT-0640-20-29M-02    | Attenuator, 20dB                     | 17-May-11 | 16-May-12 |
| CIS035610 | Micro-Tronics     | BRC50703-02           | Notch Filter, SB:5.150-5.350GHz      | 7-Jul-10  | 7-Jul-11  |
| CIS035605 | Micro-Tronics     | BRC50704-02           | Notch Filter, SB:5.470-5.725GHz      | 7-Jul-10  | 7-Jul-11  |
| CIS034303 | Micro-Tronics     | BRM50702-02           | Notch Filter, SB:2.4-2.5GHz          | 7-Jul-10  | 7-Jul-11  |
| CIS043116 | Huber + Suhner    | Sucoflex 104PE        | N & SMA RF cable                     | 19-Jul-10 | 19-Jul-11 |
| CIS040603 | Agilent           | E4440A                | Spectrum Analyzer                    | 4-Aug-10  | 4-Aug-11  |
| CIS040053 | Agilent           | E4448A                | Spectrum Analyzer                    | 29-Apr-11 | 28-Apr-12 |