



**MET Laboratories, Inc.** *Safety Certification - EMI - Telecom Environmental Simulation*

914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230-3432 • PHONE (410) 354-3300 • FAX (410) 354-3313

33439 WESTERN AVENUE • UNION CITY, CALIFORNIA 94587 • PHONE (510) 489-6300 • FAX (510) 489-6372

3162 BELICK STREET • SANTA CLARA, CALIFORNIA 95054 • PHONE (408) 748-3585 • FAX (510) 489-6372

December 30, 2009

Firetide, Inc.  
16795 Lark Ave. Suite 200  
Los Gatos, CA 95032

Dear Paul Richards,

Enclosed is the EMC Wireless test report for compliance testing of the Firetide, Inc., 7100 Indoor Unit as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Title 47 of the CFR, Part 15, Subpart B, Industry Canada ICES-003 Issue 4 February 2004 for Unintentional Radiators and Part 15.407, Industry Canada RSS-210, Issue 7, June 2007 for Intentional Radiators.

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,  
MET LABORATORIES, INC.

Jennifer Warnell  
Documentation Department

Reference: (\Firetide, Inc.\EMCS81748A-FCC407 Rev. 1)

Certificates and reports shall not be reproduced except in full, without the written permission of MET Laboratories, Inc.



**MET Laboratories, Inc.** *Safety Certification - EMI - Telecom Environmental Simulation*  
33439 WESTERN AVENUE • UNION CITY, CALIFORNIA 94587-3201 • PHONE (510) 489-6300 • FAX (510) 489-6372

## **Electromagnetic Compatibility Criteria Test Report**

for the

**Firetide, Inc.  
Model 7100 Indoor Unit**

**Tested under**  
the Certification Rules  
contained in  
Title 47 of the CFR, Part 15, Subpart B and  
ICES-003 Issue 4 February 2004  
for Unintentional Radiators  
and  
Title 47 of the CFR, Part 15.407 and  
Industry Canada RSS-210, Issue 7, June 2007  
for Intentional Radiators

**MET Report: EMCS81748A-FCC407 Rev. 1**

December 30, 2009

**Prepared For:**

**Firetide, Inc.  
16795 Lark Ave. Suite 200  
Los Gatos, CA 95032**

**Prepared By:**  
**MET Laboratories, Inc.**  
914 W. Patapsco Ave.  
Baltimore, MD 21230

## Electromagnetic Compatibility Criteria Test Report

for the

**Firetide, Inc.**  
**Model 7100 Indoor Unit**

the Certification Rules  
contained in  
Title 47 of the CFR, Part 15, Subpart B and  
ICES-003 Issue 4 February 2004  
for Unintentional Radiators  
and  
Title 47 of the CFR, Part 15.407 and  
Industry Canada RSS-210, Issue 7, June 2007  
for Intentional Radiators



Minh Ly, Project Engineer  
Electromagnetic Compatibility Lab



Jennifer Warnell  
Documentation Department

**Engineering Statement:** The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Parts 15B, 15.407, of the FCC Rules and ICES-003 and RSS-210 of the Industry Canada rules under normal use and maintenance.



Shawn McMillen, Wireless Manager  
Electromagnetic Compatibility Lab

## Report Status Sheet

| Revision | Report Date       | Reason for Revision                                                    |
|----------|-------------------|------------------------------------------------------------------------|
| Ø        | October 28, 2009  | Initial Issue.                                                         |
| 1        | December 30, 2009 | Revised to correct Output Power plots for the 802.11n 40MHz bandwidth. |

## Table of Contents

|             |                                                                                 |           |
|-------------|---------------------------------------------------------------------------------|-----------|
| <b>I.</b>   | <b>Executive Summary .....</b>                                                  | <b>1</b>  |
|             | A. Purpose of Test .....                                                        | 2         |
|             | B. Executive Summary .....                                                      | 2         |
| <b>II.</b>  | <b>Equipment Configuration .....</b>                                            | <b>3</b>  |
|             | A. Overview.....                                                                | 4         |
|             | B. References.....                                                              | 5         |
|             | C. Test Site .....                                                              | 5         |
|             | D. Description of Test Sample.....                                              | 6         |
|             | E. Equipment Configuration.....                                                 | 8         |
|             | F. Support Equipment .....                                                      | 8         |
|             | G. Ports and Cabling Information.....                                           | 8         |
|             | H. Mode of Operation.....                                                       | 9         |
|             | I. Method of Monitoring EUT Operation.....                                      | 9         |
|             | J. Modifications .....                                                          | 9         |
|             | a) Modifications to EUT.....                                                    | 9         |
|             | b) Modifications to Test Standard.....                                          | 9         |
|             | K. Disposition of EUT.....                                                      | 9         |
| <b>III.</b> | <b>Electromagnetic Compatibility Criteria for Unintentional Radiators .....</b> | <b>10</b> |
|             | § 15.107(a) Conducted Emissions Limits.....                                     | 11        |
|             | § 15.109(a) Radiated Emissions Limits.....                                      | 14        |
| <b>IV.</b>  | <b>Electromagnetic Compatibility Criteria for Intentional Radiators.....</b>    | <b>19</b> |
|             | § 15.203 Antenna Requirement .....                                              | 20        |
|             | § 15.207 Conducted Emissions Limits .....                                       | 21        |
|             | § 15.403(c) 26dB Bandwidth .....                                                | 24        |
|             | § 15.407(a) RF Power Output .....                                               | 33        |
|             | § 15.407(a)(1)(2) Peak Power Spectral Density .....                             | 42        |
|             | § 15.407(a)(6) Peak Excursion Ratio .....                                       | 53        |
|             | § 15.407(b) Undesirable Emissions.....                                          | 62        |
|             | a) Radiated Harmonic Emissions.....                                             | 64        |
|             | b) Radiated Spurious Emissions .....                                            | 67        |
|             | c) EIRP .....                                                                   | 73        |
|             | § 15.407(f) RF Exposure .....                                                   | 78        |
|             | § 15.407(g) Frequency Stability .....                                           | 79        |
| <b>V.</b>   | <b>Test Equipment .....</b>                                                     | <b>86</b> |
| <b>VI.</b>  | <b>Certification &amp; User's Manual Information.....</b>                       | <b>88</b> |
|             | A. Certification Information .....                                              | 89        |
|             | B. Label and User's Manual Information .....                                    | 93        |
| <b>VII.</b> | <b>ICES-003 Procedural &amp; Labeling Requirements.....</b>                     | <b>95</b> |

## List of Tables

|                                                                                                                                 |    |
|---------------------------------------------------------------------------------------------------------------------------------|----|
| Table 1. Executive Summary of EMC Part 15.407 Compliance Testing .....                                                          | 2  |
| Table 2. EUT Summary.....                                                                                                       | 4  |
| Table 3. References .....                                                                                                       | 5  |
| Table 4. Equipment Configuration .....                                                                                          | 8  |
| Table 5. Support Equipment.....                                                                                                 | 8  |
| Table 6. Ports and Cabling Information .....                                                                                    | 8  |
| Table 7. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Subsections 15.107(a) (b) and 15.207(a) ..... | 11 |
| Table 8. Conducted Emissions - Voltage, AC Power, Test Results .....                                                            | 12 |
| Table 9. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b) .....                                           | 14 |
| Table 10. Radiated Emissions, Test Results, FCC Limits, 30 MHz – 1 GHz .....                                                    | 15 |
| Table 11. Radiated Emissions, Test Results, FCC Limits, 1GHz – 6GHz .....                                                       | 16 |
| Table 12. Radiated Emissions, Test Results, ICES-003 Limits, 30 MHz – 1 GHz .....                                               | 17 |
| Table 13. Antenna Information .....                                                                                             | 20 |
| Table 14. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a) .....                                         | 21 |
| Table 15. Conducted Emissions - Voltage, AC Power, Test Results .....                                                           | 22 |
| Table 16. Occupied Bandwidth, Port 1, Test Results .....                                                                        | 25 |
| Table 17. Occupied Bandwidth, Port 2, Test Results .....                                                                        | 25 |
| Table 18. Occupied Bandwidth, Port 3, Test Results .....                                                                        | 25 |
| Table 19. Output Power Requirements from §15.407 .....                                                                          | 33 |
| Table 20. RF Power Output, Test Results, Port 1.....                                                                            | 34 |
| Table 21. RF Power Output, Test Results, Port 2.....                                                                            | 34 |
| Table 22. RF Power Output, Test Results, Port 3.....                                                                            | 34 |
| Table 23. RF Power Output, Test Results, Sum Power .....                                                                        | 34 |
| Table 24. Peak Power Spectral Density, Test Results, Port 1 .....                                                               | 43 |
| Table 25. Peak Power Spectral Density, Test Results, Port 2 .....                                                               | 43 |
| Table 26. Peak Power Spectral Density, Test Results, Port 3 .....                                                               | 43 |
| Table 27. Peak Power Spectral Density, Test Results, Combined Ports .....                                                       | 43 |
| Table 28. Peak Excursion Ration, Test Results, Port 1 .....                                                                     | 54 |
| Table 29. Peak Excursion Ration, Test Results, Port 2 .....                                                                     | 54 |
| Table 30. Peak Excursion Ration, Test Results, Port 3 .....                                                                     | 54 |
| Table 31. Restricted Bands of Operation.....                                                                                    | 62 |
| Table 32. Radiated Harmonics, Port 1, 802.11a, 5 dBi Omni, 5180 MHz .....                                                       | 64 |
| Table 33. Radiated Harmonics, Port 1, 802.11a, 5 dBi Omni, 5240 MHz .....                                                       | 64 |
| Table 34. Radiated Harmonics, 802.11n 20MHz, 5 dBi Omni, 5180 MHz .....                                                         | 65 |
| Table 35. Radiated Harmonics, 802.11n 20MHz, 5 dBi Omni, 5240 MHz .....                                                         | 65 |
| Table 36. Radiated Harmonics, 802.11n 40MHz, 5 dBi Omni, 5190 MHz .....                                                         | 66 |
| Table 37. Radiated Harmonics, 802.11n 40MHz, 5 dBi Omni, 5230 MHz .....                                                         | 66 |
| Table 38. EIRP Calculation .....                                                                                                | 73 |
| Table 39. Test Equipment List .....                                                                                             | 87 |

## List of Figures

|                                                        |    |
|--------------------------------------------------------|----|
| Figure 1. Block Diagram of Test Configuration.....     | 7  |
| Figure 2. Occupied Bandwidth Test Setup .....          | 24 |
| Figure 3. Peak Power Output Test Setup.....            | 33 |
| Figure 4. Peak Power Spectral Density Test Setup ..... | 42 |

## List of Plots

|                                                                               |    |
|-------------------------------------------------------------------------------|----|
| Plot 1. Conducted Emission, Phase Line Plot .....                             | 12 |
| Plot 2. Conducted Emission, Neutral Line Plot.....                            | 13 |
| Plot 3. Radiated Emissions, Pre-Scan, FCC Limits, 30 MHz – 1 GHz .....        | 15 |
| Plot 4. Radiated Emissions, Pre-Scan, FCC Limits, 1 GHz – 6 GHz.....          | 16 |
| Plot 5. Radiated Emissions, Pre-Scan, ICES-003 Limits, 30 MHz – 1 GHz.....    | 17 |
| Plot 6. §15.207 Conducted Emissions, Phase Line Plot, 7100 Indoor Unit .....  | 22 |
| Plot 7. §15.207 Conducted Emissions, Neutral Line Plot, 7100 Indoor Unit..... | 23 |
| Plot 8. Occupied Bandwidth, Port 1, 802.11a, 5180 MHz .....                   | 26 |
| Plot 9. Occupied Bandwidth, Port 1, 802.11a, 5240 MHz .....                   | 26 |
| Plot 10. Occupied Bandwidth, Port 1, 802.11n 20MHz, 5180 MHz .....            | 27 |
| Plot 11. Occupied Bandwidth, Port 1, 802.11n 20MHz, 5240 MHz .....            | 27 |
| Plot 12. Occupied Bandwidth, Port 1, 802.11n 40MHz, 5190 MHz .....            | 28 |
| Plot 13. Occupied Bandwidth, Port 1, 802.11n 40MHz, 5230 MHz .....            | 28 |
| Plot 14. Occupied Bandwidth, Port 2, 802.11n 20MHz, 5180 MHz .....            | 29 |
| Plot 15. Occupied Bandwidth, Port 2, 802.11n 20MHz, 5240 MHz .....            | 29 |
| Plot 16. Occupied Bandwidth, Port 2, 802.11n 40MHz, 5190 MHz .....            | 30 |
| Plot 17. Occupied Bandwidth, Port 2, 802.11n 40MHz, 5230 MHz .....            | 30 |
| Plot 18. Occupied Bandwidth, Port 3, 802.11n 20MHz, 5180 MHz .....            | 31 |
| Plot 19. Occupied Bandwidth, Port 3, 802.11n 20MHz, 5240 MHz .....            | 31 |
| Plot 20. Occupied Bandwidth, Port 3, 802.11n 40MHz, 5190 MHz .....            | 32 |
| Plot 21. Occupied Bandwidth, Port 3, 802.11n 40MHz, 5230 MHz .....            | 32 |
| Plot 22. RF Power Output, Port 1, 802.11a, 5180 MHz .....                     | 35 |
| Plot 23. RF Power Output, Port 1, 802.11a, 5240 MHz .....                     | 35 |
| Plot 24. RF Power Output, Port 1, 802.11n 20MHz, 5180 MHz.....                | 36 |
| Plot 25. RF Power Output, Port 1, 802.11n 20MHz, 5240 MHz.....                | 36 |
| Plot 26. RF Power Output, Port 1, 802.11n 40MHz, 5190 MHz.....                | 37 |
| Plot 27. RF Power Output, Port 1, 802.11n 40MHz, 5230 MHz.....                | 37 |
| Plot 28. RF Power Output, Port 2, 802.11n 20MHz, 5180 MHz.....                | 38 |
| Plot 29. RF Power Output, Port 2, 802.11n 20MHz, 5240 MHz.....                | 38 |
| Plot 30. RF Power Output, Port 2, 802.11n 40MHz, 5190 MHz.....                | 39 |
| Plot 31. RF Power Output, Port 2, 802.11n 40MHz, 5230 MHz.....                | 39 |
| Plot 32. RF Power Output, Port 3, 802.11n 20MHz, 5180 MHz.....                | 40 |
| Plot 33. RF Power Output, Port 3, 802.11n 20MHz, 5240 MHz.....                | 40 |
| Plot 34. RF Power Output, Port 3, 802.11n 40MHz, 5190 MHz.....                | 41 |
| Plot 35. RF Power Output, Port 3, 802.11n 40MHz, 5230 MHz.....                | 41 |
| Plot 36. PPSD, Port 1, 802.11a, 5180 MHz.....                                 | 44 |
| Plot 37. PPSD, Port 1, 802.11a, 5240 MHz.....                                 | 44 |
| Plot 38. PPSD, \ Port 1, 802.11n 20MHz, 5180 MHz .....                        | 45 |
| Plot 39. PPSD, Port 1, 802.11n 20MHz, 5240 MHz .....                          | 45 |
| Plot 40. PPSD, Port 1, 802.11n 40MHz, 5190 MHz .....                          | 46 |
| Plot 41. PPSD, Port 1, 802.11n 40MHz, 5230 MHz .....                          | 46 |
| Plot 42. PPSD, Port 2, 802.11n 20MHz, 5180 MHz .....                          | 47 |
| Plot 43. PPSD, Port 2, 802.11n 20MHz, 5240 MHz .....                          | 47 |
| Plot 44. PPSD, Port 2, 802.11n 40MHz, 5190 MHz .....                          | 48 |
| Plot 45. PPSD, Port 2, 802.11n 40MHz, 5230 MHz .....                          | 48 |
| Plot 46. PPSD, Port 3, 802.11n 20MHz, 5180 MHz .....                          | 49 |
| Plot 47. PPSD, Port 3, 802.11n 20MHz, 5240 MHz .....                          | 49 |
| Plot 48. PPSD, Port 3, 802.11n 40MHz, 5190 MHz .....                          | 50 |
| Plot 49. PPSD, Port 3, 802.11n 40MHz, 5230 MHz .....                          | 50 |
| Plot 50. PPSD, Combined Ports, 802.11n 20MHz, 5180 MHz .....                  | 51 |
| Plot 51. PPSD, Combined Ports, 802.11n 20MHz, 5240 MHz .....                  | 51 |
| Plot 52. PPSD, Combined Ports, 802.11n 40MHz, 5190 MHz .....                  | 52 |
| Plot 53. PPSD, Combined Ports, 802.11n 40MHz, 5230 MHz .....                  | 52 |
| Plot 54. Peak Excursion, Port 1, 802.11a, 5180 MHz .....                      | 55 |
| Plot 55. Peak Excursion, Port 1, 802.11a, 5240 MHz .....                      | 55 |

|                                                                             |    |
|-----------------------------------------------------------------------------|----|
| Plot 56. Peak Excursion, Port 1, 802.11n 20MHz, 5180 MHz.....               | 56 |
| Plot 57. Peak Excursion, Port 1, 802.11n 20MHz, 5240 MHz.....               | 56 |
| Plot 58. Peak Excursion, Port 1, 802.11n 40MHz, 5190 MHz.....               | 57 |
| Plot 59. Peak Excursion, Port 1, 802.11n 40MHz, 5230 MHz.....               | 57 |
| Plot 60. Peak Excursion, Port 2, 802.11n 20MHz, 5180 MHz.....               | 58 |
| Plot 61. Peak Excursion, Port 2, 802.11n 20MHz, 5240 MHz.....               | 58 |
| Plot 62. Peak Excursion, Port 2, 802.11n 40MHz, 5190 MHz.....               | 59 |
| Plot 63. Peak Excursion, Port 2, 802.11n 40MHz, 5230 MHz.....               | 59 |
| Plot 64. Peak Excursion, Port 3, 802.11n 20MHz, 5180 MHz.....               | 60 |
| Plot 65. Peak Excursion, Port 3, 802.11n 20MHz, 5240 MHz.....               | 60 |
| Plot 66. Peak Excursion, Port 3, 802.11n 40MHz, 5190 MHz.....               | 61 |
| Plot 67. Peak Excursion, Port 3, 802.11n 40MHz, 5230 MHz.....               | 61 |
| Plot 68. Radiated Spurious, Port 1, 802.11a, 5180 MHz, 30 MHz – 1 GHz ..... | 67 |
| Plot 69. Radiated Spurious, Port 1, 802.11a, 5180 MHz, 1 GHz – 18 GHz ..... | 67 |
| Plot 70. Radiated Spurious, Port 1, 802.11a, 5240 MHz, 30 MHz – 1 GHz ..... | 68 |
| Plot 71. Radiated Spurious, Port 1, 802.11a, 5240 MHz, 1 GHz – 18 GHz ..... | 68 |
| Plot 72. Radiated Spurious, 802.11n 20MHz, 5180 MHz, 30 MHz – 1 GHz.....    | 69 |
| Plot 73. Radiated Spurious, 802.11n 20MHz, 5180 MHz, 1 GHz – 18 GHz .....   | 69 |
| Plot 74. Radiated Spurious, 802.11n 20MHz, 5240 MHz, 30 MHz – 1 GHz.....    | 70 |
| Plot 75. Radiated Spurious, 802.11n 20MHz, 5240 MHz, 1 GHz – 18 GHz .....   | 70 |
| Plot 76. Radiated Spurious, 802.11n 40MHz, 5190 MHz, 30 MHz – 1 GHz.....    | 71 |
| Plot 77. Radiated Spurious, 802.11n 40MHz, 5190 MHz, 1 GHz – 18 GHz .....   | 71 |
| Plot 78. Radiated Spurious, 802.11n 40MHz, 5230 MHz, 30 MHz – 1 GHz.....    | 72 |
| Plot 79. Radiated Spurious, 802.11n 40MHz, 5230 MHz, 1 GHz – 18 GHz .....   | 72 |
| Plot 80. EIRP, Port 1, 802.11a, 5150 MHz Peak.....                          | 74 |
| Plot 81. EIRP, Port 1, 802.11a, 5150 MHz Over 1 MHz .....                   | 74 |
| Plot 82. EIRP, 802.11n 20MHz, 5150 MHz Peak.....                            | 75 |
| Plot 83. EIRP, 802.11n 20MHz, 5150 MHz Over 1 MHz.....                      | 75 |
| Plot 84. EIRP, 802.11n 40MHz, 5150 MHz Peak.....                            | 76 |
| Plot 85. EIRP, 802.11n 40MHz, 5150 MHz Over 1 MHz.....                      | 76 |
| Plot 86. Freq. Stability, Port 1, 5180 MHz @-40C Low Volt. ....             | 80 |
| Plot 87. Freq. Stability, Port 1, 5180 MHz @-40C High Volt. ....            | 80 |
| Plot 88. Freq. Stability, Port 1, 5180 MHz @+60C Low Volt. ....             | 81 |
| Plot 89. Freq. Stability, Port 1, 5180 MHz @+60C High Volt. ....            | 81 |
| Plot 90. Freq. Stability, Port 2, 5180 MHz @-40C Low Volt. ....             | 82 |
| Plot 91. Freq. Stability, Port 2, 5180 MHz @-40C High Volt. ....            | 82 |
| Plot 92. Freq. Stability, Port 2, 5180 MHz @+60C Low Volt. ....             | 83 |
| Plot 93. Freq. Stability, Port 2, 5180 MHz @+60C High Volt. ....            | 83 |
| Plot 94. Freq. Stability, Port 3, 5180 MHz @-40C Low Volt. ....             | 84 |
| Plot 95. Freq. Stability, Port 3, 5180 MHz @-40C High Volt. ....            | 84 |
| Plot 96. Freq. Stability, Port 3, 5180 MHz @+60C Low Volt. ....             | 85 |
| Plot 97. Freq. Stability, Port 3, 5180 MHz @+60C High Volt. ....            | 85 |

## List of Photographs

|                                                                                |    |
|--------------------------------------------------------------------------------|----|
| Photograph 1. Firetide, Inc. 7100 Indoor Unit .....                            | 6  |
| Photograph 2. Conducted Emissions Test Setup.....                              | 13 |
| Photograph 3. Radiated Emission Test Setup 30 MHz – 1 GHz .....                | 18 |
| Photograph 4. Radiated Emission Test Setup 1 GHz – 6 GHz.....                  | 18 |
| Photograph 5. Conducted Emissions, Test Setup .....                            | 23 |
| Photograph 6. Test Equipment and Setup for Various Radiated Measurements ..... | 77 |



## List of Terms and Abbreviations

|                              |                                                  |
|------------------------------|--------------------------------------------------|
| <b>AC</b>                    | <b>Alternating Current</b>                       |
| <b>ACF</b>                   | <b>Antenna Correction Factor</b>                 |
| <b>Cal</b>                   | <b>Calibration</b>                               |
| <b><i>d</i></b>              | <b>Measurement Distance</b>                      |
| <b>dB</b>                    | <b>Decibels</b>                                  |
| <b>dB<math>\mu</math>A</b>   | <b>Decibels above one microamp</b>               |
| <b>dB<math>\mu</math>V</b>   | <b>Decibels above one microvolt</b>              |
| <b>dB<math>\mu</math>A/m</b> | <b>Decibels above one microamp per meter</b>     |
| <b>dB<math>\mu</math>V/m</b> | <b>Decibels above one microvolt per meter</b>    |
| <b>DC</b>                    | <b>Direct Current</b>                            |
| <b>E</b>                     | <b>Electric Field</b>                            |
| <b>DSL</b>                   | <b>Digital Subscriber Line</b>                   |
| <b>ESD</b>                   | <b>Electrostatic Discharge</b>                   |
| <b>EUT</b>                   | <b>Equipment Under Test</b>                      |
| <b><i>f</i></b>              | <b>Frequency</b>                                 |
| <b>FCC</b>                   | <b>Federal Communications Commission</b>         |
| <b>GRP</b>                   | <b>Ground Reference Plane</b>                    |
| <b>H</b>                     | <b>Magnetic Field</b>                            |
| <b>HCP</b>                   | <b>Horizontal Coupling Plane</b>                 |
| <b>Hz</b>                    | <b>Hertz</b>                                     |
| <b>IEC</b>                   | <b>International Electrotechnical Commission</b> |
| <b>kHz</b>                   | <b>kilohertz</b>                                 |
| <b>kPa</b>                   | <b>kilopascal</b>                                |
| <b>kV</b>                    | <b>kilovolt</b>                                  |
| <b>LISN</b>                  | <b>Line Impedance Stabilization Network</b>      |
| <b>MHz</b>                   | <b>Megahertz</b>                                 |
| <b><math>\mu</math>H</b>     | <b>microhenry</b>                                |
| <b><math>\mu</math></b>      | <b>microfarad</b>                                |
| <b><math>\mu</math>s</b>     | <b>microseconds</b>                              |
| <b>PRF</b>                   | <b>Pulse Repetition Frequency</b>                |
| <b>RF</b>                    | <b>Radio Frequency</b>                           |
| <b>RMS</b>                   | <b>Root-Mean-Square</b>                          |
| <b>TWT</b>                   | <b>Traveling Wave Tube</b>                       |
| <b>V/m</b>                   | <b>Volts per meter</b>                           |
| <b>VCP</b>                   | <b>Vertical Coupling Plane</b>                   |

# **I. Executive Summary**

## A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Firetide, Inc. 7100 Indoor Unit, with the requirements of Part 15, §15.407. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the 7100 Indoor Unit. Firetide, Inc. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the 7100 Indoor Unit, has been **permanently** discontinued.

## B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, §15.407, in accordance with Firetide, Inc., purchase order number 2475. All tests were conducted using measurement procedure ANSI C63.4-2003.

| FCC Reference                | Industry Canada Reference         | Description                                                                   | Results   |
|------------------------------|-----------------------------------|-------------------------------------------------------------------------------|-----------|
| 15.107                       | ICES-003 Issue 4<br>February 2004 | Conducted Emissions                                                           | Compliant |
| 15.109                       |                                   | Radiated Emissions                                                            | Compliant |
| 15.203                       | RSS-GEN 7.1.4                     | Antenna Requirements                                                          | Compliant |
| 15.205/15.209                | 2.2                               | General Field Strength Limits (Restricted Bands and Radiated Emission Limits) | Compliant |
| 15.207                       | RSS-GEN 7.2.2;<br>RSS-210 2.2     | AC Conducted Emissions 150KHz – 30MHz                                         | Compliant |
| 15.403 (c)                   | A8.2                              | 26dB Occupied Bandwidth                                                       | Compliant |
| 15.407 (a)(1), (2), (3)      | A9.2(3)                           | Conducted Transmitter Output Power                                            | Compliant |
| 15.407 (a)(1), (2), (3), (5) | A9.2(3)                           | Power Spectral Density                                                        | Compliant |
| 15.407 (a)(6)                | A8.2                              | Peak Excursion                                                                | Compliant |
| 15.407 (b)(1), (2), (5), (6) | A9.3(4)                           | Undesirable Emissions                                                         | Compliant |
| 15.407(f)                    | RSS-GEN                           | RF Exposure                                                                   | Compliant |
| 15.407(g)                    | 2.1                               | Frequency Stability                                                           | Compliant |

**Table 1. Executive Summary of EMC Part 15.407 Compliance Testing**

## II. Equipment Configuration

## A. Overview

MET Laboratories, Inc. was contracted by Firetide, Inc. to perform testing on the 7100 Indoor Unit, under Firetide, Inc.'s purchase order number 2475.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Firetide, Inc. 7100 Indoor Unit.

The results obtained relate only to the item(s) tested.

|                                       |                                                         |                |          |
|---------------------------------------|---------------------------------------------------------|----------------|----------|
| <b>Model(s) Tested:</b>               | 7100 Indoor Unit                                        |                |          |
| <b>Model(s) Covered:</b>              | 7100 Indoor Unit                                        |                |          |
| <b>EUT Specifications:</b>            | Primary Power: 12 VDC                                   |                |          |
|                                       | FCC ID: REP-7100-1                                      |                |          |
|                                       | Type of Modulations:                                    | OFDM           |          |
|                                       | Emission Designators:                                   | 802.11a:       | 16M6D7D  |
|                                       |                                                         | 802.11n 20MHz: | 17M7D7D  |
|                                       |                                                         | 802.11n 40MHz: | 36M9D7D  |
|                                       | Equipment Code:                                         | NII            |          |
|                                       | Peak RF Output Power:                                   | 802.11a:       | 15.55dBm |
|                                       |                                                         | 802.11n 20MHz: | 12.22dBm |
|                                       |                                                         | 802.11n 40MHz: | 11.97dBm |
| MIMO All Ports:                       |                                                         | 16.57dBm       |          |
| EUT Frequency Ranges:                 | 5180 MHz – 5240MHz                                      |                |          |
| <b>Analysis:</b>                      | The results obtained relate only to the item(s) tested. |                |          |
| <b>Environmental Test Conditions:</b> | Temperature: 15-35° C                                   |                |          |
|                                       | Relative Humidity: 30-60%                               |                |          |
|                                       | Barometric Pressure: 860-1060 mbar                      |                |          |
| <b>Evaluated by:</b>                  | Minh Ly                                                 |                |          |
| <b>Report Date(s):</b>                | December 30, 2009                                       |                |          |

**Table 2. EUT Summary**

## B. References

|                                        |                                                                                                                                        |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>CFR 47, Part 15, Subpart B</b>      | Electromagnetic Compatibility: Criteria for Radio Frequency Devices                                                                    |
| <b>CFR 47, Part 15, Subpart E</b>      | Unlicensed National Information Infrastructure Devices (UNII)                                                                          |
| <b>RSS-210, Issue 7, June 2007</b>     | Low-power Licence-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment                                       |
| <b>ICES-003, Issue 4 February 2004</b> | Electromagnetic Compatibility: Criteria for Radio Frequency Devices                                                                    |
| <b>ANSI C63.4:2003</b>                 | Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz |
| <b>ANSI/NCSL Z540-1-1994</b>           | Calibration Laboratories and Measuring and Test Equipment - General Requirements                                                       |
| <b>ANSI/ISO/IEC 17025:2000</b>         | General Requirements for the Competence of Testing and Calibration Laboratories                                                        |

**Table 3. References**

## C. Test Site

All testing was performed at MET Laboratories, Inc., 3162 Belick Street, Santa Clara, CA 95054. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

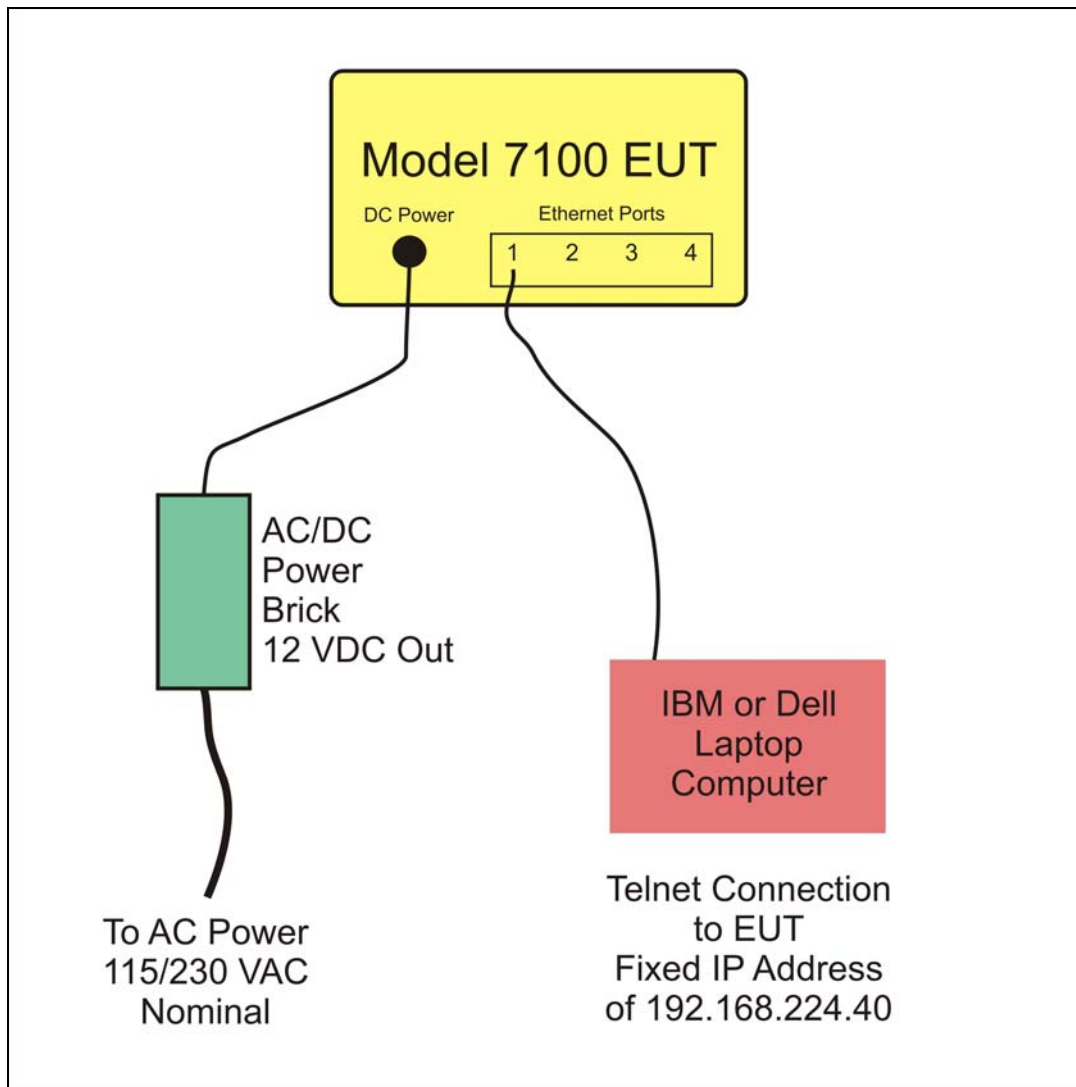
Radiated Emissions measurements were performed in a 10 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

## D. Description of Test Sample

The Firetide, Inc. 7100 Indoor Unit, is a Dual Radio Wireless Mesh Node.



Photograph 1. Firetide, Inc. 7100 Indoor Unit



**Figure 1. Block Diagram of Test Configuration**



## E. Equipment Configuration

The EUT was set up as outlined in Figure 1, Block Diagram of Test Setup. All cards, racks, etc., incorporated as part of the EUT is included in the following list.

| Ref. ID | Slot # | Name / Description       | Model Number | Part Number | Serial Number | Rev. # |
|---------|--------|--------------------------|--------------|-------------|---------------|--------|
| N/A     | N/A    | HOTPORT INDOOR MESH NODE | 7100         | 7100        | N/A           | 1      |

**Table 4. Equipment Configuration**

## F. Support Equipment

Firetide, Inc. supplied support equipment necessary for the operation and testing of the 7100 Indoor Unit. All support equipment supplied is listed in the following Support Equipment List.

| Ref. ID | Name / Description | Manufacturer   | Model Number   | *Customer Supplied Calibration Data |
|---------|--------------------|----------------|----------------|-------------------------------------|
| N/A     | LAPTOP COMPUTER    | IBM            | T42            | N/A                                 |
| N/A     | LAPTOP COMPUTER    | DELL           | N/A            | N/A                                 |
| N/A     | AC/DC POWER BRICK  | FSP GROUP INC. | FSP040-1ADF03A | N/A                                 |

**Table 5. Support Equipment**

\* The 'Customer Supplied Calibration Data' column will be marked as either not applicable, not available, or will contain the calibration date supplied by the customer.

## G. Ports and Cabling Information

| Ref. ID | Port name on EUT | Cable Description or reason for no cable                                       | Qty. | Length (m) | Shielded (Y/N) | Termination Box ID & Port Name |
|---------|------------------|--------------------------------------------------------------------------------|------|------------|----------------|--------------------------------|
| N/A     | PORT 1           | ETHERNET                                                                       | 1    | 1.5        | N              | LAPTOP                         |
| N/A     | PORT 2 – 4       | NOT CONNECTED; ONLY 1 ETHERNET CONNECTION IS NECESSARY TO COMMUNICATE WITH EUT | N/A  | N/A        | N/A            | N/A                            |
| N/A     | POWER            | DC POWER IN FROM POWER BRICK; 2.1 MM PLUG                                      | 1    | 1          | N              | N/A                            |
| N/A     | USB              | NOT USED; DISABLED                                                             | N/A  | N/A        | N/A            | N/A                            |

**Table 6. Ports and Cabling Information**

## **H. Mode of Operation**

The UUT has the Atheros Radio Test (ART) software loaded. The UUT can be put into continuous TX or RX using ART. The Mesh Node has a default IP address of 192.168.224.150. An external computer can ping this address to verify the Ethernet PHY and processor are running.

## **I. Method of Monitoring EUT Operation**

An external computer can ping this address to verify the Ethernet PHY and processor are running.

## **J. Modifications**

### **a) Modifications to EUT**

No modification were made to the EUT.

### **b) Modifications to Test Standard**

No modifications were made to the test standard.

## **K. Disposition of EUT**

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Firetide, Inc. upon completion of testing.

### **III. Electromagnetic Compatibility Criteria for Unintentional Radiators**

## Electromagnetic Compatibility Criteria

### § 15.107 Conducted Emissions Limits

**Test Requirement(s):** **15.107 (a)** Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 7. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

**15.107 (b)** For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 7. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

| Frequency range<br>(MHz)                                                                                    | Class A Conducted Limits<br>(dB $\mu$ V) |         | *Class B Conducted<br>Limits (dB $\mu$ V) |         |
|-------------------------------------------------------------------------------------------------------------|------------------------------------------|---------|-------------------------------------------|---------|
|                                                                                                             | Quasi-Peak                               | Average | Quasi-Peak                                | Average |
| * 0.15- 0.45                                                                                                | 79                                       | 66      | 66 - 56                                   | 56 - 46 |
| 0.45 - 0.5                                                                                                  | 79                                       | 66      | 56                                        | 46      |
| 0.5 - 30                                                                                                    | 73                                       | 60      | 60                                        | 50      |
| Note 1 — The lower limit shall apply at the transition frequencies.                                         |                                          |         |                                           |         |
| Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz. |                                          |         |                                           |         |
| * -- Limits per Subsection 15.207(a).                                                                       |                                          |         |                                           |         |

**Table 7. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Subsections 15.107(a) (b) and 15.207(a)**

**Test Results:** The EUT was found compliant with the Class B requirement(s) of this section. Measured emissions were below applicable limits.

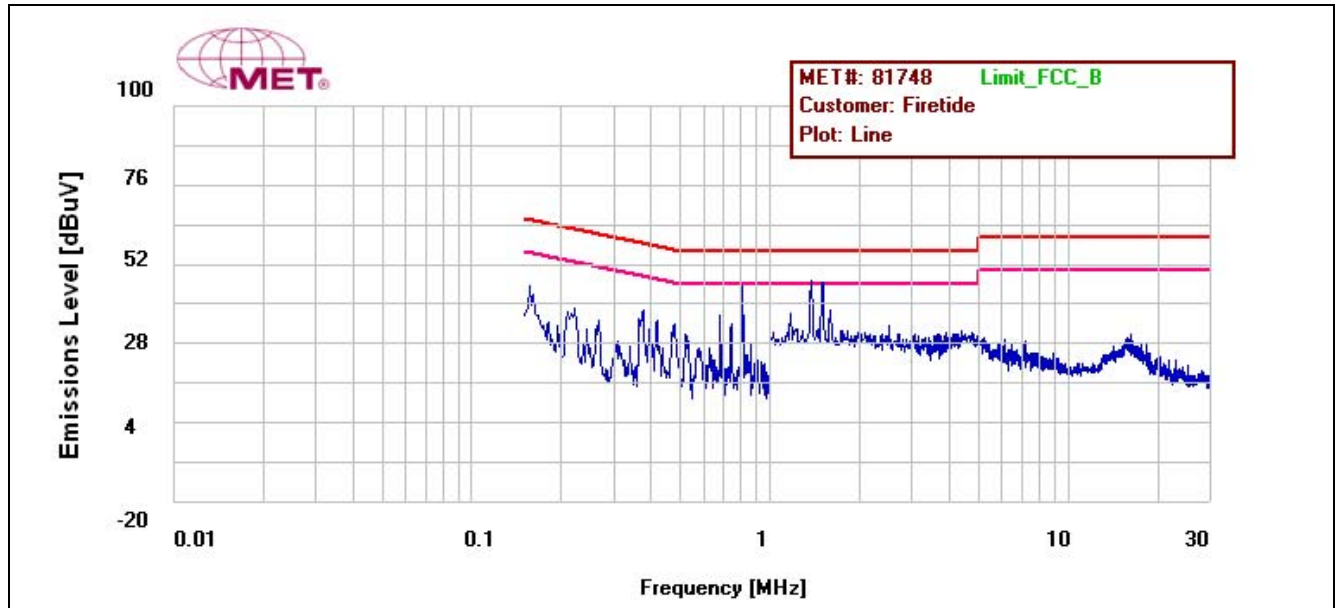
**Test Engineer(s):** Minh Ly

**Test Date(s):** 08/06/09

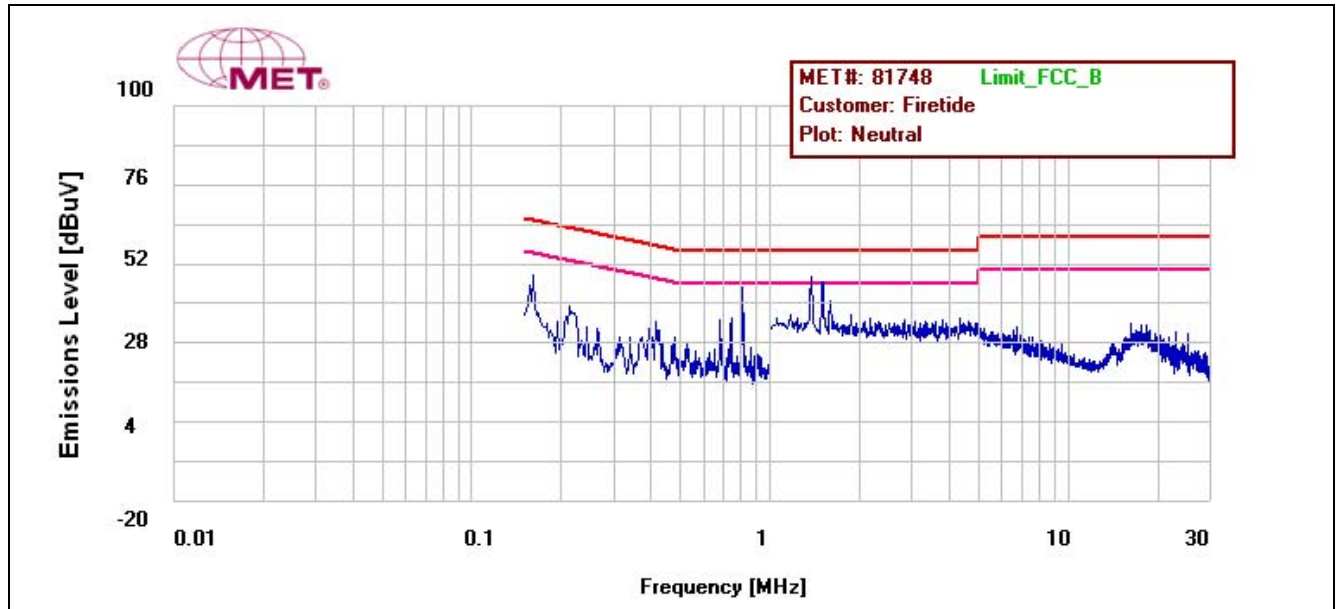
## Conducted Emissions - Voltage, AC Power

| Line    | Freq (MHz) | QP Amplitude | QP Limit | Delta  | Pass | Average Amplitude | Average Limit | Delta | Pass |
|---------|------------|--------------|----------|--------|------|-------------------|---------------|-------|------|
| Line    | 0.809      | 48.48        | 56       | -7.52  | Pass | 44.48             | 46            | -1.52 | Pass |
| Line    | 1.37       | 45.08        | 56       | -10.92 | Pass | 41.72             | 46            | -4.28 | Pass |
| Line    | 1.5        | 42.8         | 56       | -13.2  | Pass | 40.39             | 46            | -5.61 | Pass |
| Neutral | 0.810      | 47.88        | 56       | -8.12  | Pass | 44.88             | 46            | -1.12 | Pass |
| Neutral | 1.371      | 45.01        | 56       | -10.99 | Pass | 42.16             | 46            | -3.84 | Pass |
| Neutral | 1.5        | 40.76        | 56       | -15.24 | Pass | 39.93             | 46            | -6.07 | Pass |

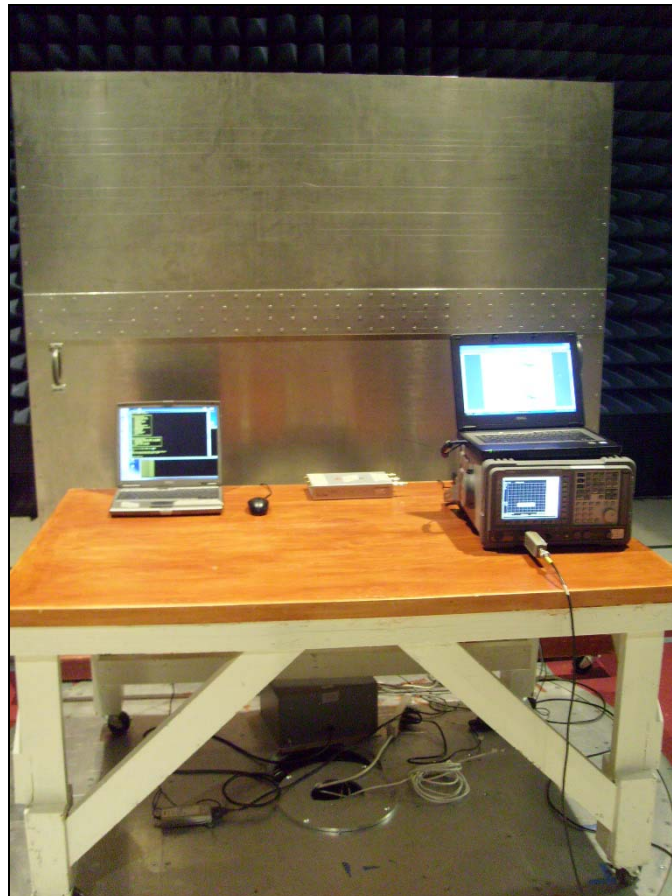
Table 8. Conducted Emissions - Voltage, AC Power, Test Results



Plot 1. Conducted Emission, Phase Line Plot



Plot 2. Conducted Emission, Neutral Line Plot



Photograph 2. Conducted Emissions Test Setup

## Radiated Emission Limits

### § 15.109 Radiated Emissions Limits

**Test Requirement(s):** **15.109 (a)** Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the Class B limits expressed in Table 9.

**15.109 (b)** The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the Class A limits expressed in Table 9.

| Frequency (MHz) | Field Strength (dBμV/m)                    |                                           |
|-----------------|--------------------------------------------|-------------------------------------------|
|                 | §15.109 (b), Class A Limit<br>(dBμV) @ 10m | §15.109 (a), Class B Limit<br>(dBμV) @ 3m |
| 30 - 88         | 39.00                                      | 40.00                                     |
| 88 - 216        | 43.50                                      | 43.50                                     |
| 216 - 960       | 46.40                                      | 46.00                                     |
| Above 960       | 49.50                                      | 54.00                                     |

**Table 9. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b)**

**Test Procedures:** The EUT was placed on a 0.8m-high wooden table inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.4 were used. An antenna was located 3 m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1 m and 4 m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. Unless otherwise specified, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

**Test Results:** The EUT was found to comply with the Class A requirement(s) of this section. Measured emissions were below applicable limits.

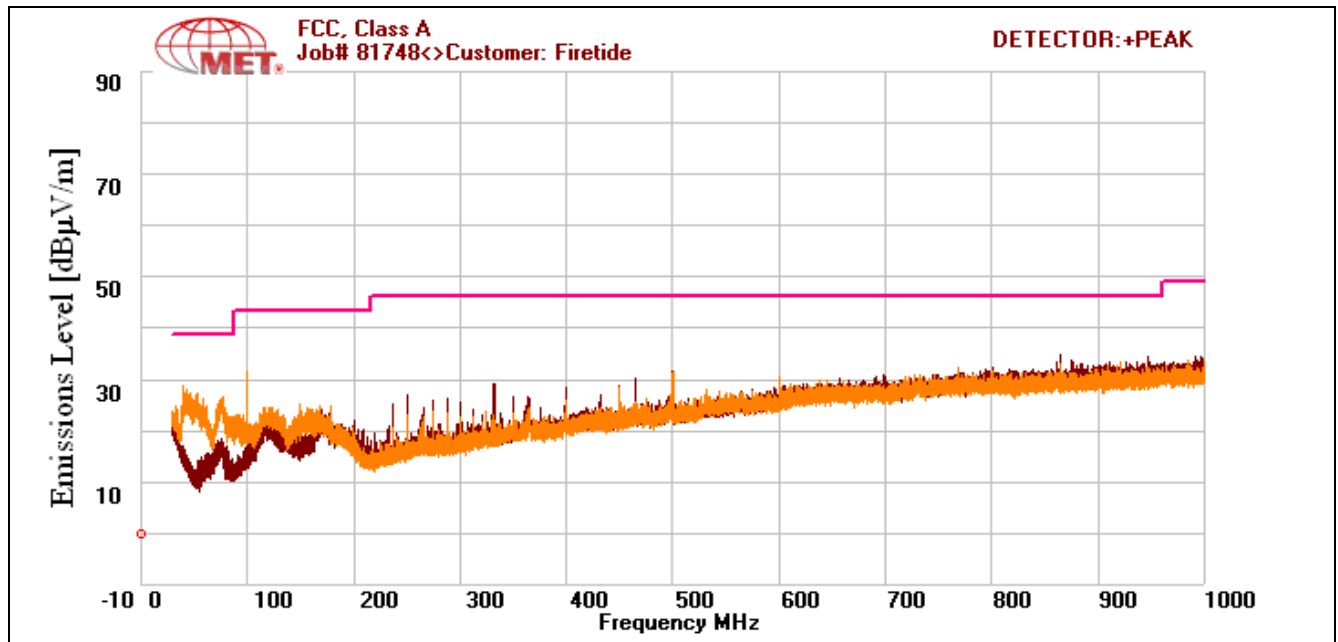
**Test Engineer(s):** Minh Ly

**Test Date(s):** 08/10/09

## Radiated Emissions Limits Test Results, Class A

| Frequency (MHz) | Antenna Polarity | EUT Azimuth (Degrees) | Antenna Height (cm) | Uncorrected Amplitude (dBuV) | ACF (dB/m) | Pre Amp Gain (dB) | CBL (dB) | DCF (dB) | Corrected Amplitude (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|------------------|-----------------------|---------------------|------------------------------|------------|-------------------|----------|----------|------------------------------|----------------|-------------|
| 100             | V                | 134                   | 100                 | 27.52                        | 12.7       | 0                 | 2.47     | -10.46   | 32.23                        | 43.5           | -11.27      |
| 500             | V                | 193                   | 100                 | 19.49                        | 17.6       | 0                 | 5.74     | -10.46   | 32.37                        | 46.4           | -14.03      |
| 42.4            | V                | 139                   | 100                 | 25.2                         | 10.7       | 0                 | 1.565    | -10.46   | 27.005                       | 39             | -11.995     |
| 100             | H                | 81                    | 253                 | 23.3                         | 11.1       | 0                 | 2.47     | -10.46   | 26.41                        | 43.5           | -17.09      |
| 332             | H                | 0                     | 100                 | 18.48                        | 14.74      | 0                 | 4.636    | -10.46   | 27.396                       | 46.4           | -19.004     |
| 500             | H                | 197                   | 205                 | 17.8                         | 18         | 0                 | 5.74     | -10.46   | 31.08                        | 46.4           | -15.32      |

Table 10. Radiated Emissions, Test Results, FCC Limits, 30 MHz – 1 GHz

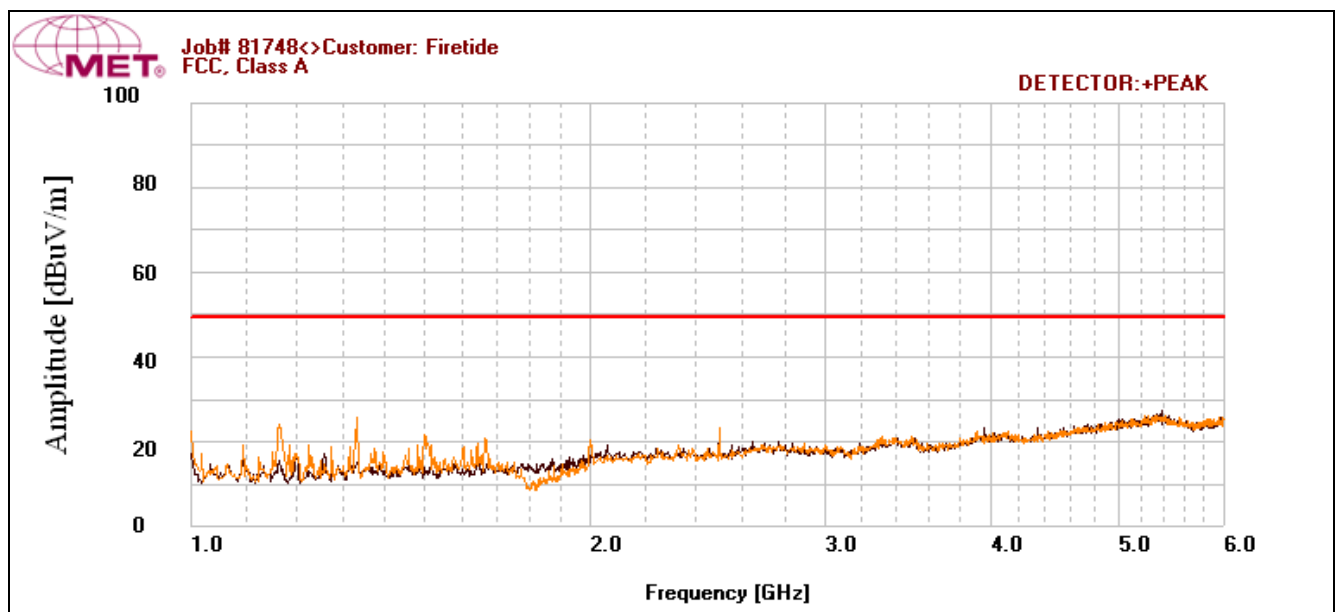


Plot 3. Radiated Emissions, Pre-Scan, FCC Limits, 30 MHz – 1 GHz



| Frequency (MHz) | Antenna Polarity | EUT Azimuth (Degrees) | Antenna Height (cm) | Uncorrected Amplitude (dBuV) | ACF (dB/m) | Pre Amp Gain (dB) | CBL (dB) | DCF (dB) | Corrected Amplitude (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|------------------|-----------------------|---------------------|------------------------------|------------|-------------------|----------|----------|------------------------------|----------------|-------------|
| 2250            | H                | 91                    | 100                 | 49.24                        | 1.485      | 34.555            | 2.187    | -10.46   | 7.897                        | 49.5           | -41.603     |
| 5000            | H                | 0                     | 100                 | 44.36                        | 8.299      | 34.415            | 4.13     | -10.46   | 11.914                       | 49.5           | -37.586     |
| 1260            | V                | 29                    | 100                 | 51.53                        | -1.552     | 35.258            | 1.686    | -10.46   | 5.946                        | 49.5           | -43.554     |
| 1328            | V                | 193                   | 100                 | 59.13                        | -1.636     | 35.155            | 1.724    | -10.46   | 13.603                       | 49.5           | -35.897     |
| 5000            | V                | 0                     | 100                 | 45.28                        | 8.299      | 34.415            | 4.13     | -10.46   | 12.834                       | 49.5           | -36.666     |

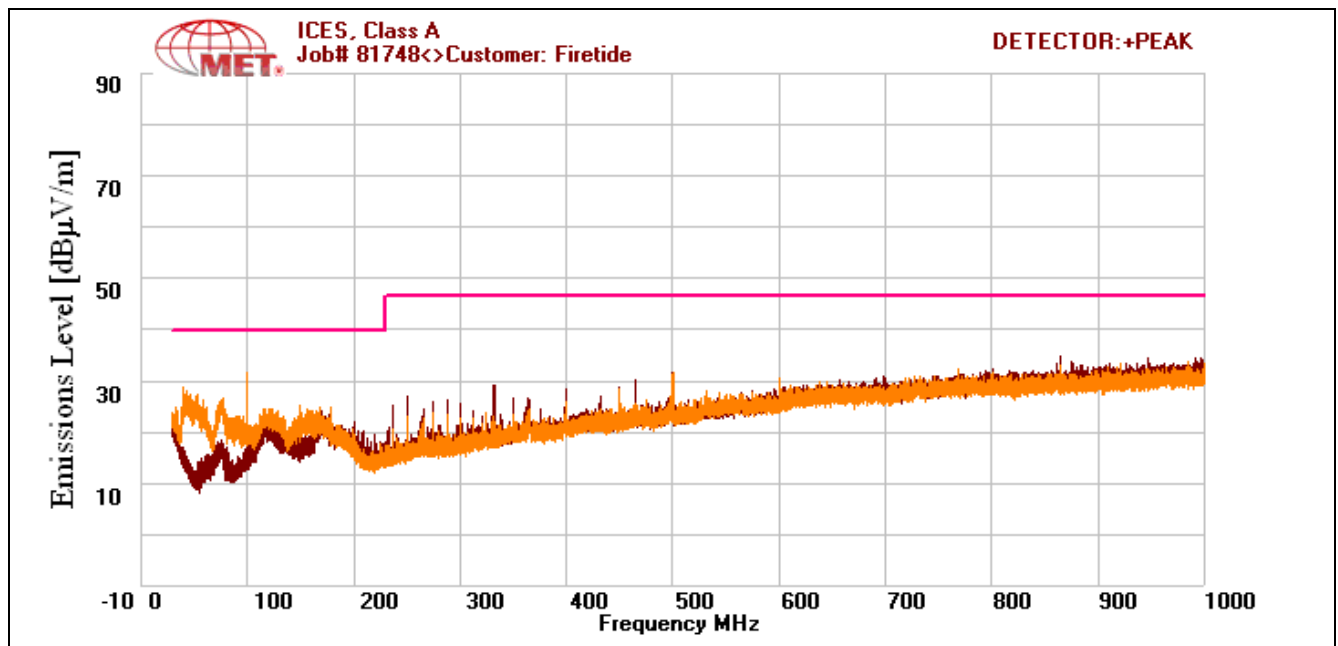
Table 11. Radiated Emissions, Test Results, FCC Limits, 1GHz – 6GHz



Plot 4. Radiated Emissions, Pre-Scan, FCC Limits, 1 GHz – 6 GHz

| Frequency (MHz) | Antenna Polarity | EUT Azimuth (Degrees) | Antenna Height (cm) | Uncorrected Amplitude (dBuV) | ACF (dB/m) | Pre Amp Gain (dB) | CBL (dB) | DCF (dB) | Corrected Amplitude (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|------------------|-----------------------|---------------------|------------------------------|------------|-------------------|----------|----------|------------------------------|----------------|-------------|
| 100             | V                | 134                   | 100                 | 27.52                        | 12.7       | 0                 | 2.47     | -10.46   | 32.23                        | 40             | -7.77       |
| 500             | V                | 193                   | 100                 | 19.49                        | 17.6       | 0                 | 5.74     | -10.46   | 32.37                        | 47             | -14.63      |
| 42.4            | V                | 139                   | 100                 | 25.2                         | 10.7       | 0                 | 1.565    | -10.46   | 27.005                       | 40             | -12.995     |
| 100             | H                | 81                    | 253                 | 23.3                         | 11.1       | 0                 | 2.47     | -10.46   | 26.41                        | 40             | -13.59      |
| 332             | H                | 0                     | 100                 | 18.48                        | 14.74      | 0                 | 4.636    | -10.46   | 27.396                       | 47             | -19.604     |

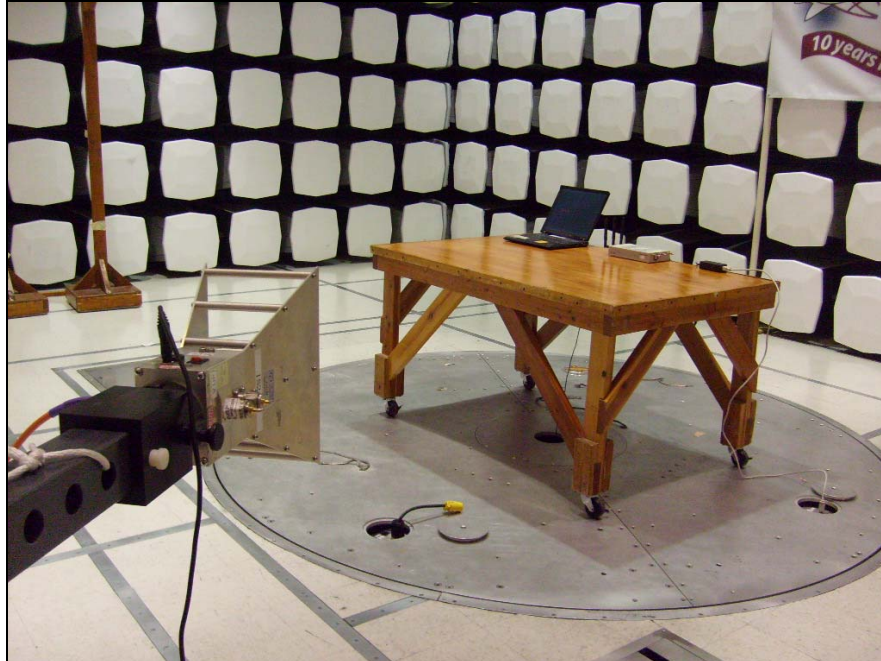
Table 12. Radiated Emissions, Test Results, ICES-003 Limits, 30 MHz – 1 GHz



Plot 5. Radiated Emissions, Pre-Scan, ICES-003 Limits, 30 MHz – 1 GHz



**Photograph 3 Radiated Emission Test Setup 30 MHz – 1 GHz**



**Photograph 4. Radiated Emission Test Setup 1 GHz – 6 GHz**

## **IV. Electromagnetic Compatibility Criteria for Intentional Radiators**

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.203 Antenna Requirement

**Test Requirement:** § 15.203: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

The structure and application of the EUT were analyzed to determine compliance with Section 15.203 of the Rules. Section 15.203 states that the subject device must meet at least one of the following criteria:

- a.) Antenna must be permanently attached to the unit.
- b.) Antenna must use a unique type of connector to attach to the EUT.
- c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

**Results:** The EUT is compliant with the §15.203 criteria. The 7100 Indoor Unit uses a unique type of connector to attach to the EUT.

| Gain/Type        | Model         | Manufacturer |
|------------------|---------------|--------------|
| 5dBi Omni (5GHz) | C812-510012-A | Wha Yu       |

**Table 13. Antenna Information**

**Test Engineer(s):** Minh Ly

**Test Date(s):** 09/02/09

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.207 Conducted Emissions Limits

**Test Requirement(s):** § 15.207 (a): For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50  $\Omega$  line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency range<br>(MHz) | § 15.207(a), Conducted Limit (dB $\mu$ V) |         |
|--------------------------|-------------------------------------------|---------|
|                          | Quasi-Peak                                | Average |
| * 0.15- 0.45             | 66 - 56                                   | 56 - 46 |
| 0.45 - 0.5               | 56                                        | 46      |
| 0.5 - 30                 | 60                                        | 50      |

**Table 14. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)**

**Test Procedure:** The EUT was placed on a 0.8 m-high wooden table inside a semi-anechoic chamber. The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a 50  $\Omega$ /50  $\mu$ H Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with ANSI C63.4-1992 "Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz". The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50  $\Omega$ /50  $\mu$ H LISN as the input transducer to an EMC/field intensity meter.

**Test Results:** The EUT was found to comply with the requirement(s) of this section. Measured emissions were below applicable limits.

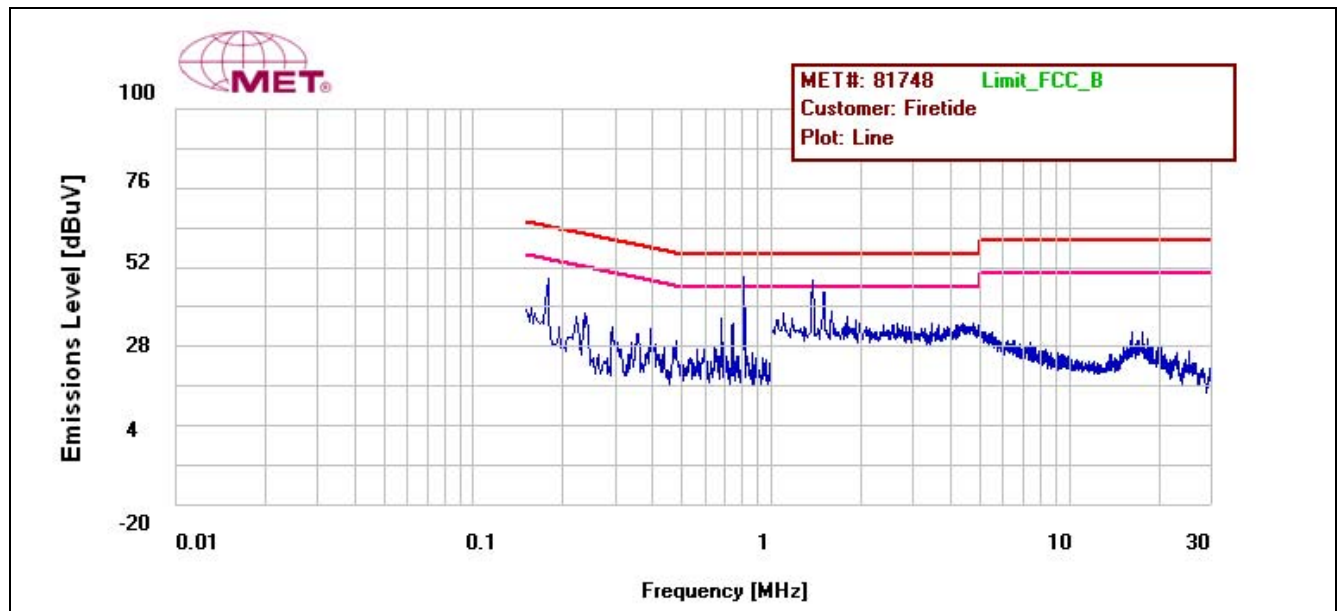
**Test Engineer(s):** Minh Ly

**Test Date(s):** 08/06/09

## Conducted Emissions - Voltage, AC Power

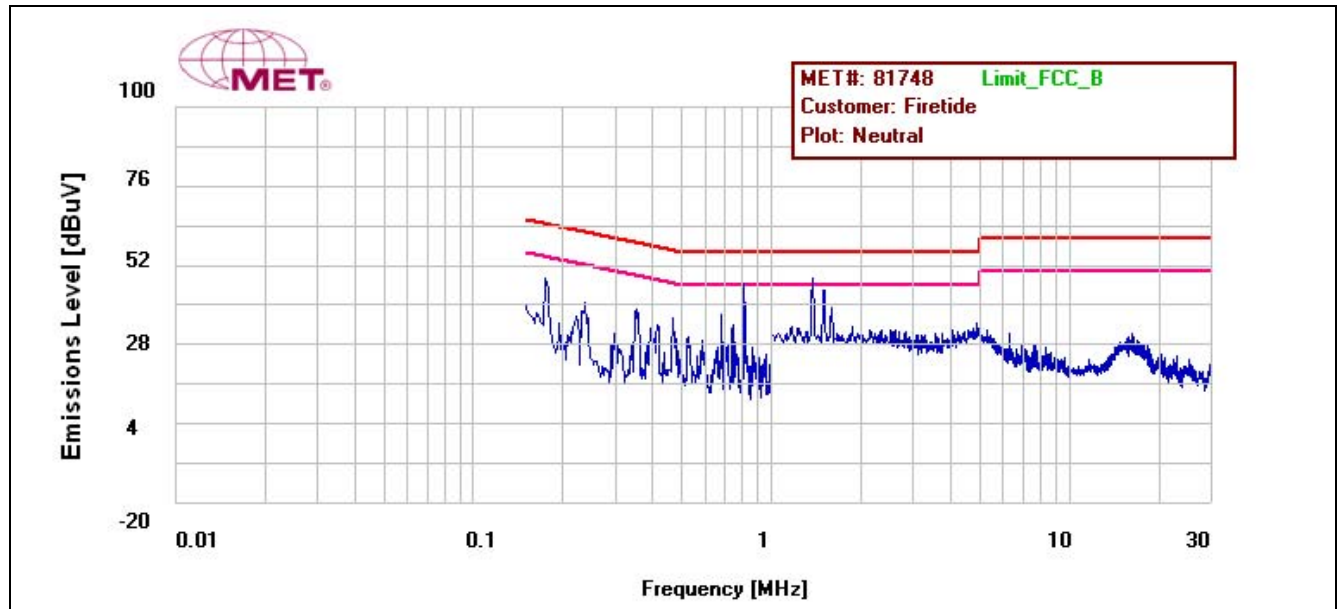
| Line    | Freq (MHz) | QP Amplitude | QP Limit | Delta  | Pass | Average Amplitude | Average Limit | Delta | Pass |
|---------|------------|--------------|----------|--------|------|-------------------|---------------|-------|------|
| Line    | 0.81       | 48.12        | 56       | -7.88  | Pass | 44.49             | 46            | -1.51 | Pass |
| Line    | 1.37       | 45.92        | 56       | -10.08 | Pass | 41.87             | 46            | -4.13 | Pass |
| Line    | 1.5        | 40.81        | 56       | -15.19 | Pass | 40.63             | 46            | -5.37 | Pass |
| Neutral | 0.809      | 45.55        | 56       | -10.45 | Pass | 43.78             | 46            | -2.22 | Pass |
| Neutral | 1.37       | 46.16        | 56       | -9.84  | Pass | 41.91             | 46            | -4.09 | Pass |
| Neutral | 1.5        | 43.79        | 56       | -12.21 | Pass | 40.02             | 46            | -5.98 | Pass |

Table 15. Conducted Emissions - Voltage, AC Power, Test Results



Plot 6. §15.207 Conducted Emissions, Phase Line Plot, 7100 Indoor Unit





Plot 7. §15.207 Conducted Emissions, Neutral Line Plot, 7100 Indoor Unit



Photograph 5. Conducted Emissions, Test Setup



## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15. 403(c) 26dB Bandwidth

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test Requirements:</b> | <b>§ 15.403 (c):</b> Operation under the provisions of this section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:                                                                                                                                                                                                                          |
| <b>Test Procedure:</b>    | The transmitter was set to the mid channel at the highest output power and connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately equal to 1% of the total emission bandwidth, VBW > RBW. The 26 dB Bandwidth was measured and recorded. The measurements were repeated at the low and high channels. |
| <b>Test Results</b>       | Equipment complies with § 15.407 (c). The 26 dB Bandwidth was determined from the plots on the following pages.                                                                                                                                                                                                                                                                                                       |
| <b>Test Engineer(s):</b>  | Minh Ly                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Test Date(s):</b>      | 07/28/09 – 08/11/09                                                                                                                                                                                                                                                                                                                                                                                                   |



**Figure 2. Occupied Bandwidth Test Setup**

| Occupied Bandwidth, Port 1 |                 |                      |                                |
|----------------------------|-----------------|----------------------|--------------------------------|
| Mode                       | Frequency (MHz) | 99 % Bandwidth (MHz) | Measured 26 dB Bandwidth (MHz) |
| 802.11a                    | 5180            | 16.4999              | 23.862                         |
|                            | 5240            | 16.6734              | 21.189                         |
| 802.11n 20MHz              | 5180            | 17.6727              | 22.807                         |
|                            | 5240            | 17.7090              | 23.328                         |
| 802.11n 40MHz              | 5190            | 36.9103              | 50.761                         |
|                            | 5230            | 36.6544              | 45.075                         |

Table 16. Occupied Bandwidth, Port 1, Test Results

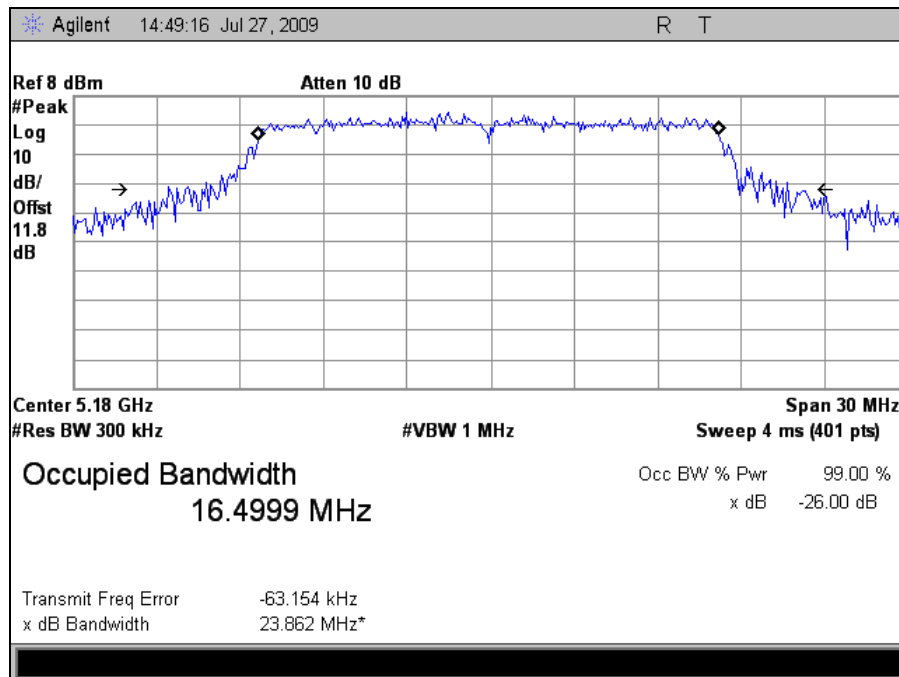
| Occupied Bandwidth, Port 2 |                 |                      |                                |
|----------------------------|-----------------|----------------------|--------------------------------|
| Mode                       | Frequency (MHz) | 99 % Bandwidth (MHz) | Measured 26 dB Bandwidth (MHz) |
| 802.11n 20MHz              | 5180            | 17.7645              | 23.516                         |
|                            | 5240            | 17.7915              | 23.033                         |
| 802.11n 40MHz              | 5190            | 36.6272              | 46.111                         |
|                            | 5230            | 36.7027              | 46.245                         |

Table 17. Occupied Bandwidth, Port 2, Test Results

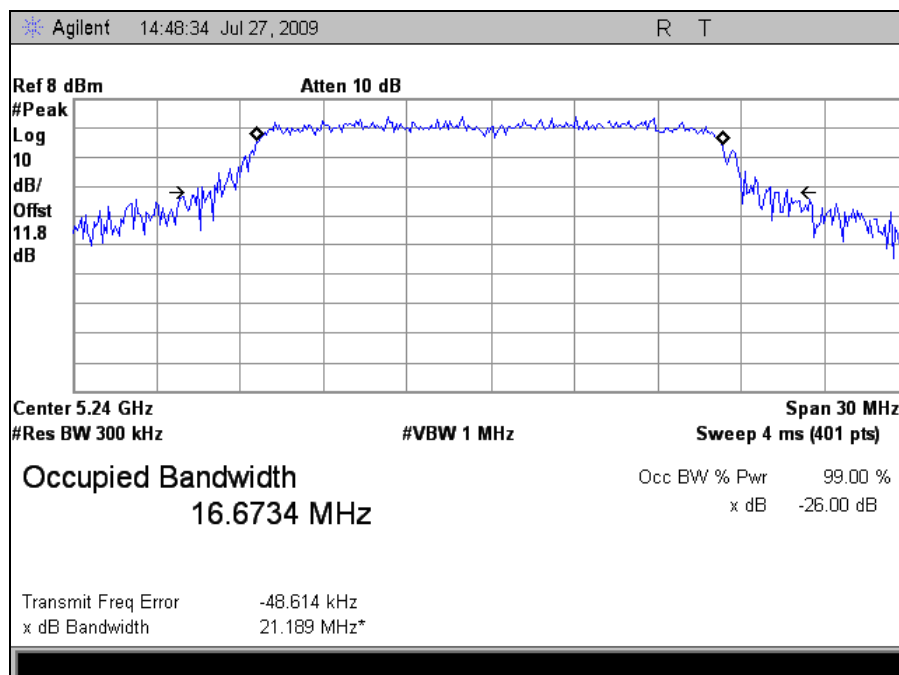
| Occupied Bandwidth, Port 3 |                 |                      |                                |
|----------------------------|-----------------|----------------------|--------------------------------|
| Mode                       | Frequency (MHz) | 99 % Bandwidth (MHz) | Measured 26 dB Bandwidth (MHz) |
| 802.11n 20MHz              | 5180            | 17.7794              | 23.976                         |
|                            | 5240            | 17.7421              | 23.454                         |
| 802.11n 40MHz              | 5190            | 36.7797              | 46.761                         |
|                            | 5230            | 36.8511              | 46.801                         |

Table 18. Occupied Bandwidth, Port 3, Test Results

## Occupied Bandwidth, Port 1

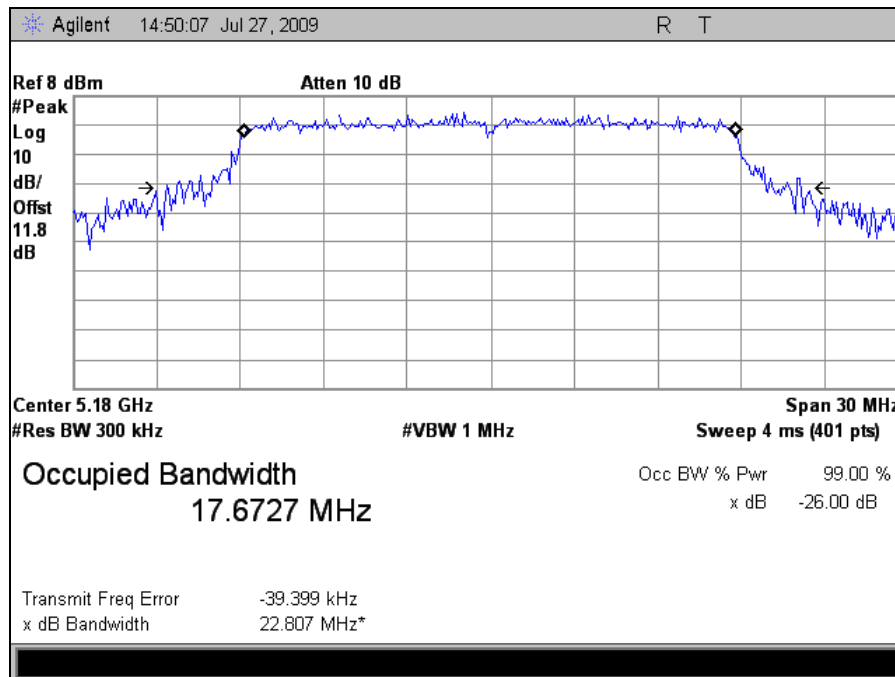


Plot 8. Occupied Bandwidth, Port 1, 802.11a, 5180 MHz

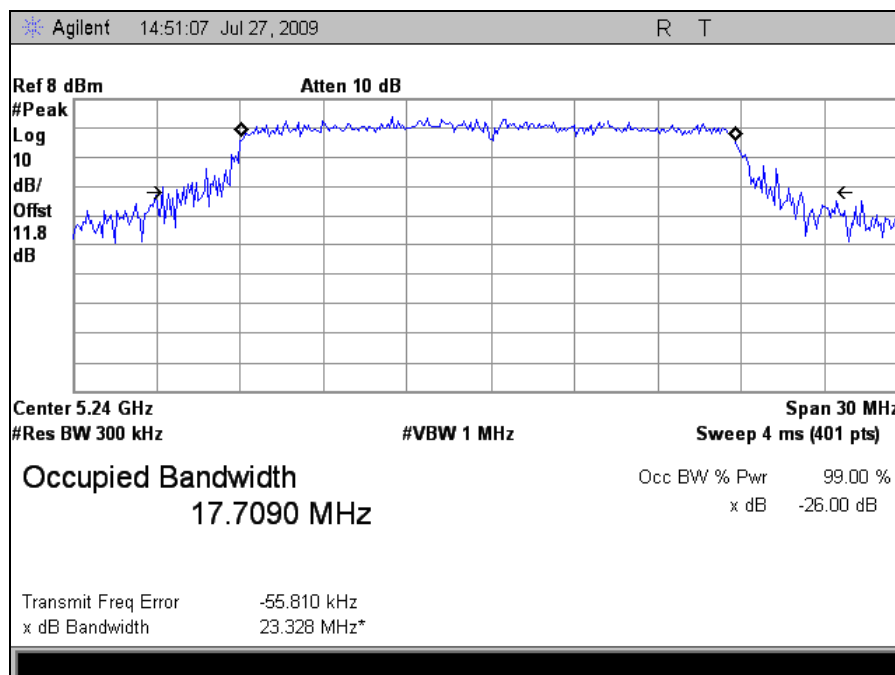


Plot 9. Occupied Bandwidth, Port 1, 802.11a, 5240 MHz

## Occupied Bandwidth, Port 1, 802.11n 20MHz

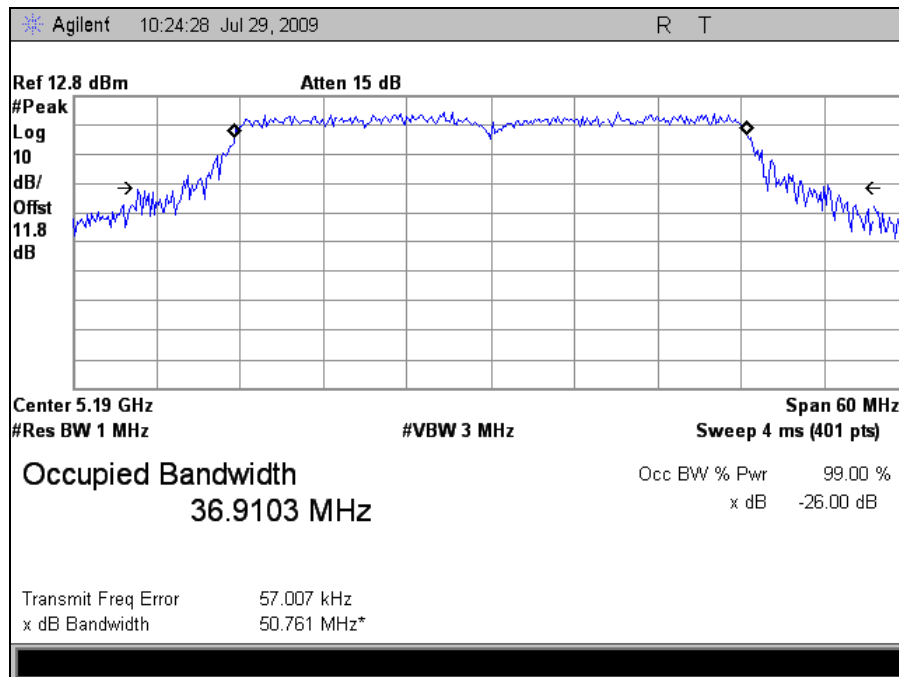


Plot 10. Occupied Bandwidth, Port 1, 802.11n 20MHz, 5180 MHz

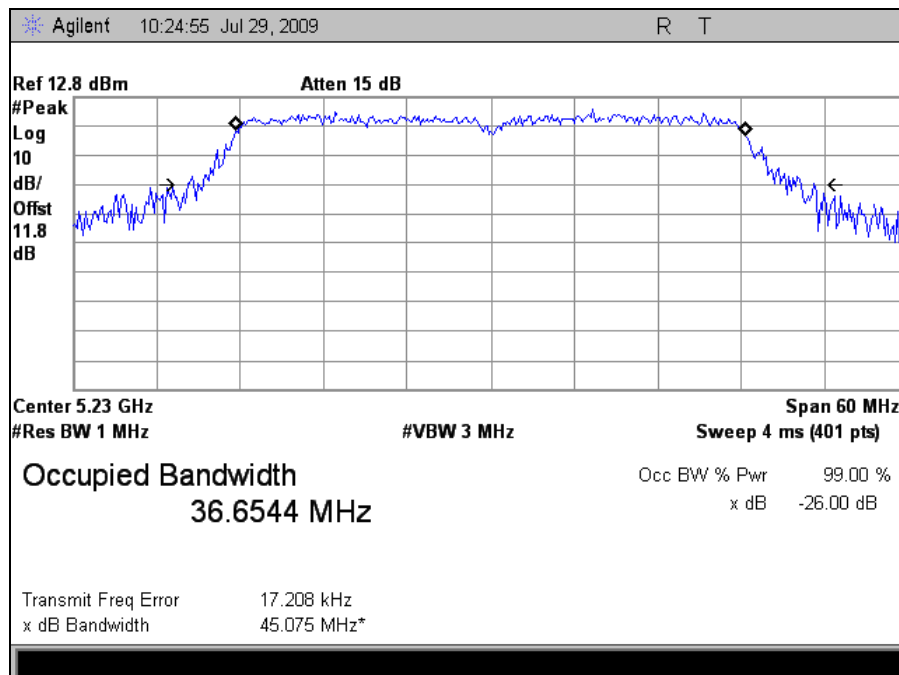


Plot 11. Occupied Bandwidth, Port 1, 802.11n 20MHz, 5240 MHz

## Occupied Bandwidth, Port 1, 802.11n 40MHz

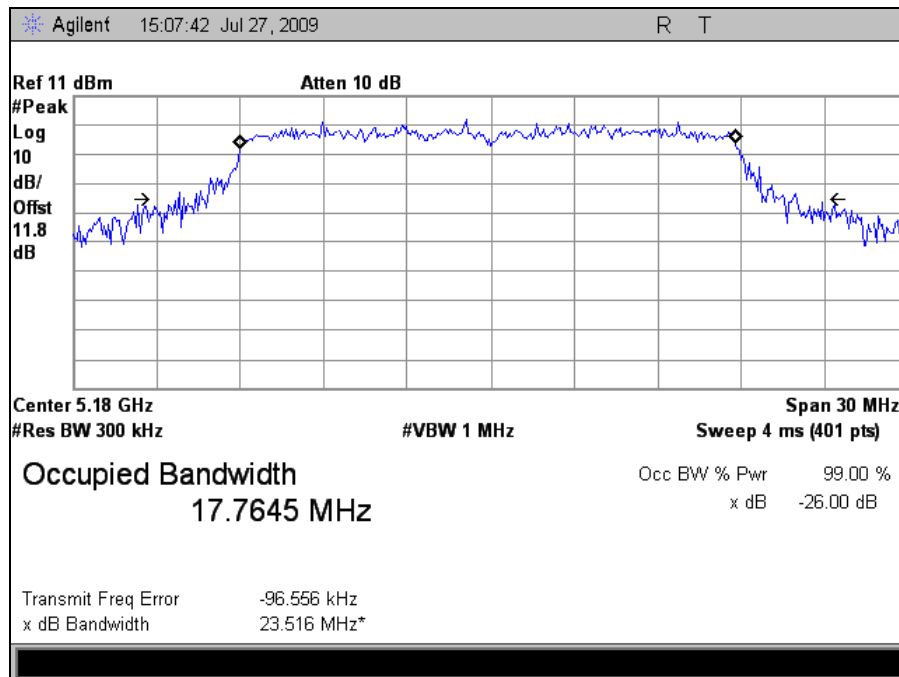


Plot 12. Occupied Bandwidth, Port 1, 802.11n 40MHz, 5190 MHz

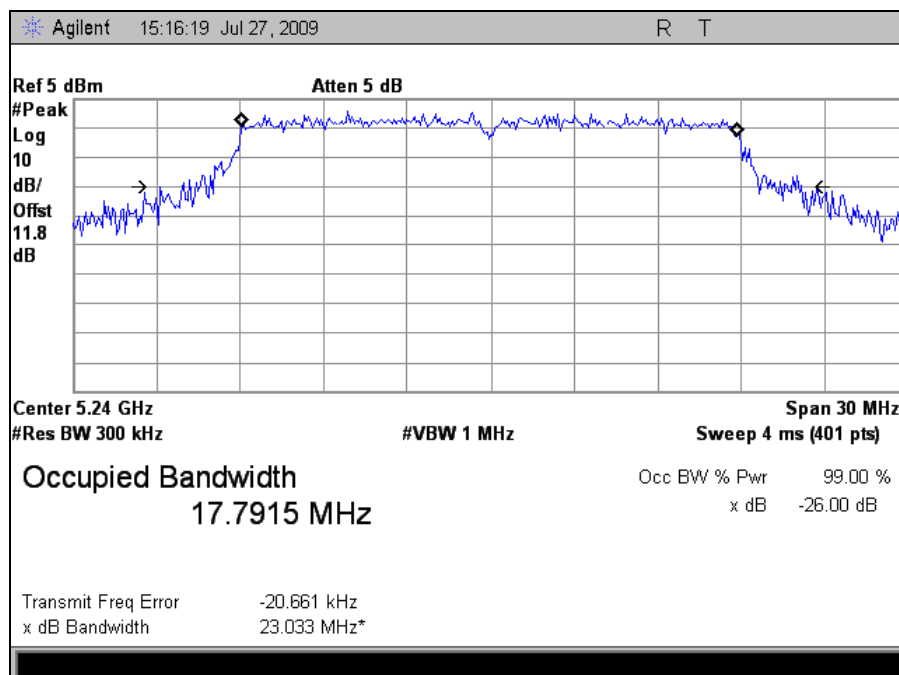


Plot 13. Occupied Bandwidth, Port 1, 802.11n 40MHz, 5230 MHz

## Occupied Bandwidth, Port 2, 802.11n 20MHz

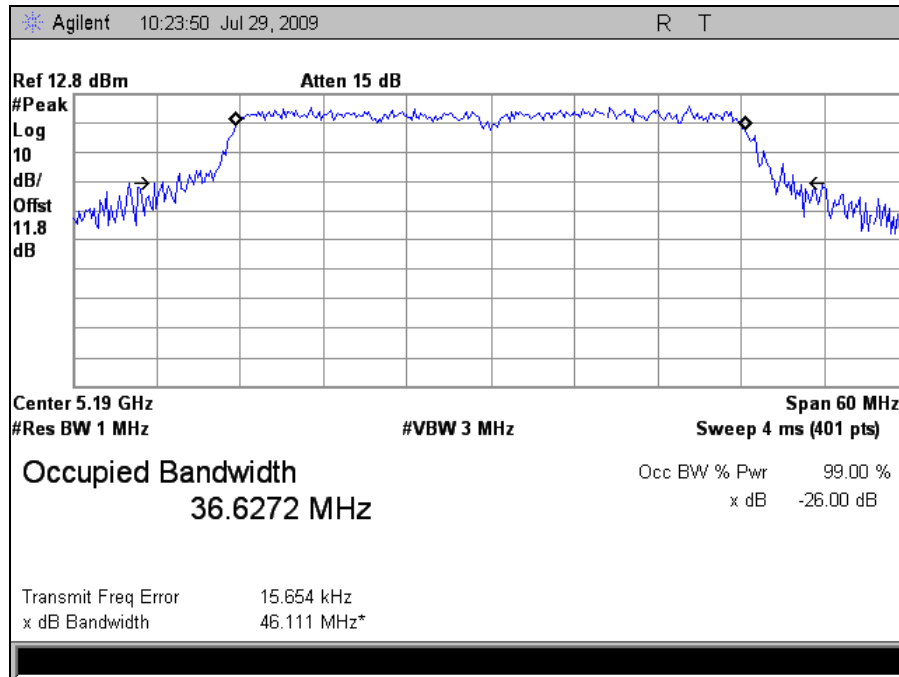


Plot 14. Occupied Bandwidth, Port 2, 802.11n 20MHz, 5180 MHz

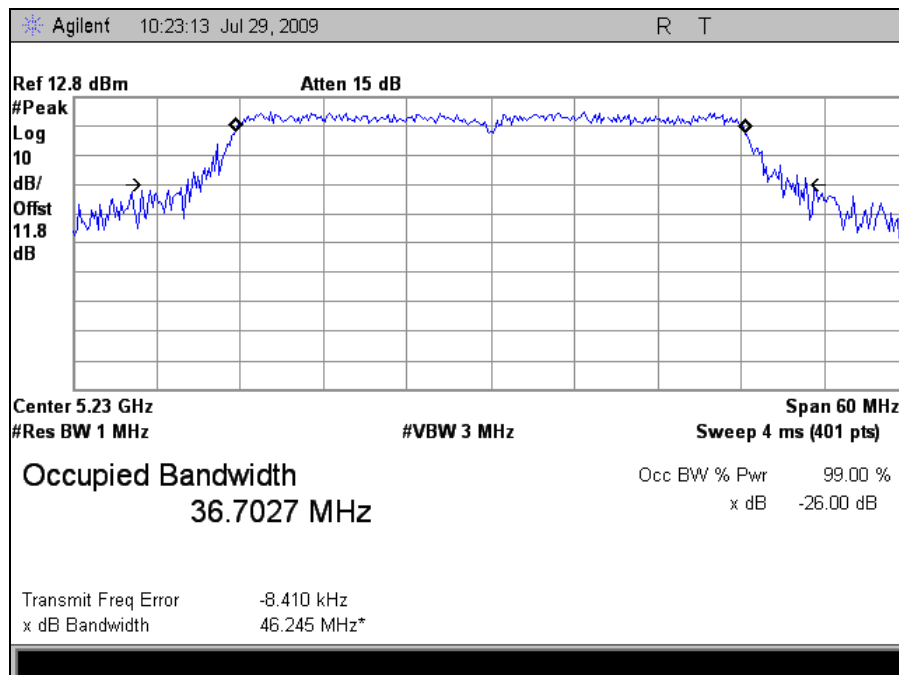


Plot 15. Occupied Bandwidth, Port 2, 802.11n 20MHz, 5240 MHz

## Occupied Bandwidth, Port 2, 802.11n 40MHz

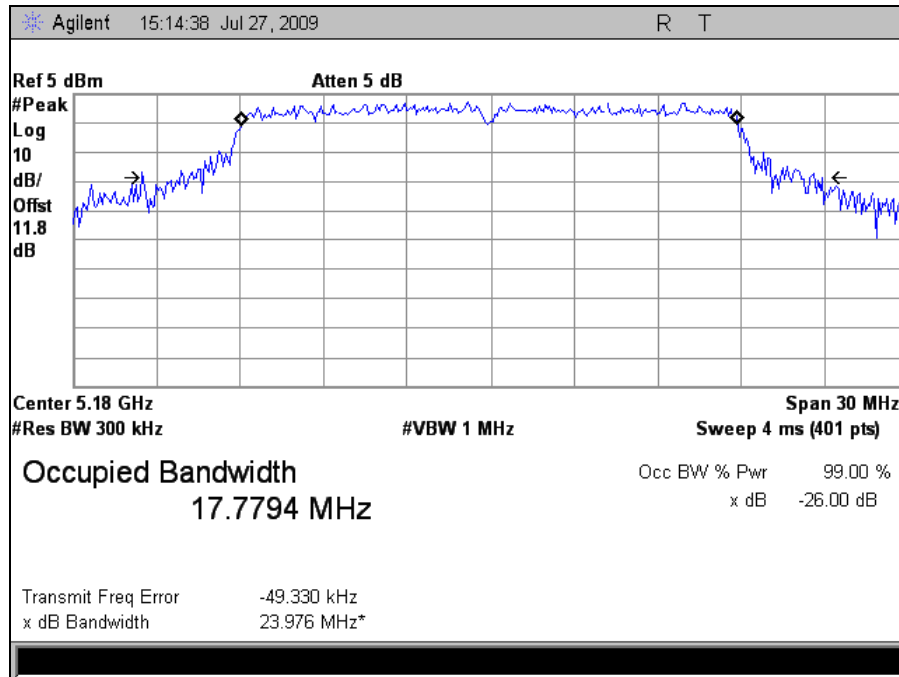


Plot 16. Occupied Bandwidth, Port 2, 802.11n 40MHz, 5190 MHz

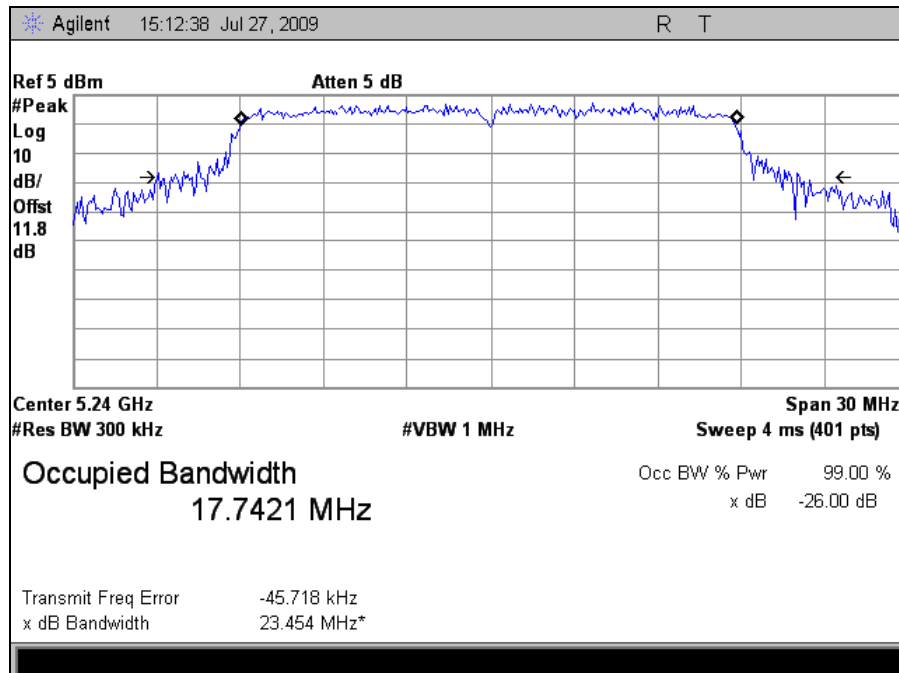


Plot 17. Occupied Bandwidth, Port 2, 802.11n 40MHz, 5230 MHz

## Occupied Bandwidth, Port 3, 802.11n 20MHz



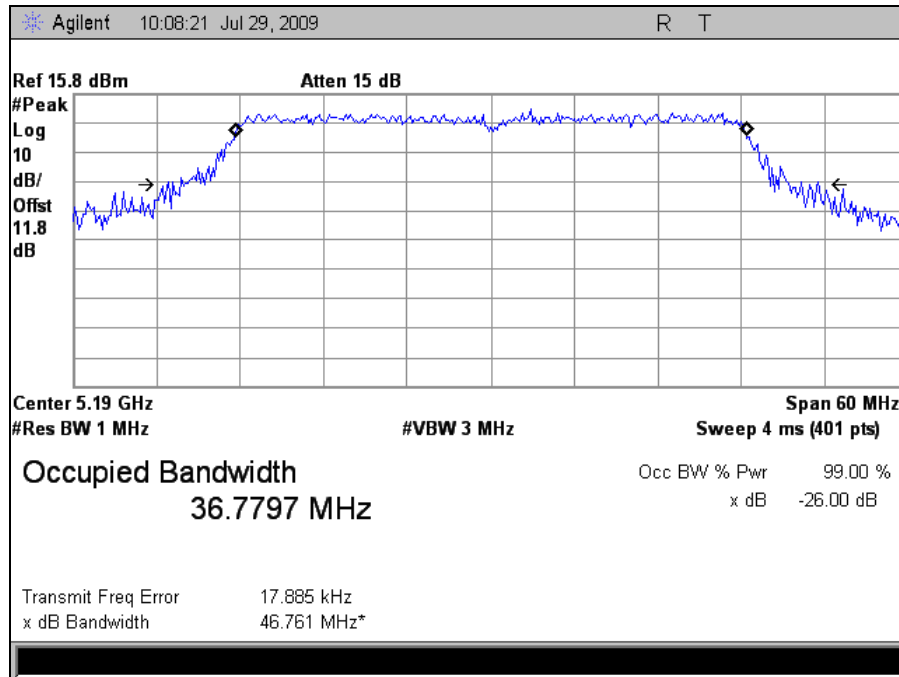
Plot 18. Occupied Bandwidth, Port 3, 802.11n 20MHz, 5180 MHz



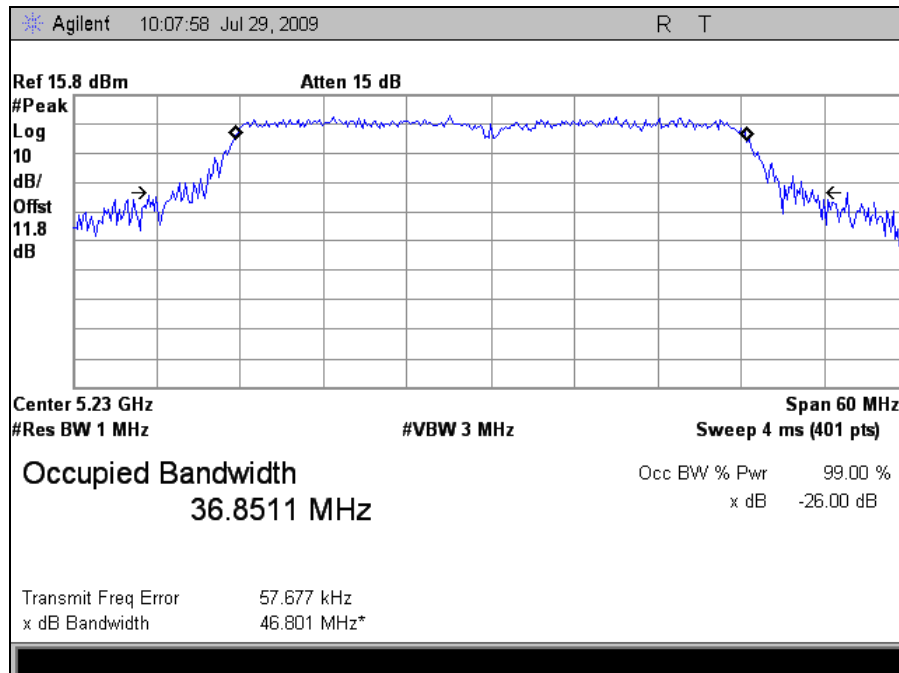
Plot 19. Occupied Bandwidth, Port 3, 802.11n 20MHz, 5240 MHz



## Occupied Bandwidth, Port 3, 802.11n 40MHz



Plot 20. Occupied Bandwidth, Port 3, 802.11n 40MHz, 5190 MHz



Plot 21. Occupied Bandwidth, Port 3, 802.11n 40MHz, 5230 MHz

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.407(a) (1) RF Power Output

**Test Requirements:** §15.407(a) (1): The maximum output power of the intentional radiator shall not exceed the following:

| Digital Transmission Systems<br>(MHz) | Output Limit<br>(mW) |
|---------------------------------------|----------------------|
| 5150-5250                             | 50                   |
| 5250-5350                             | 250                  |

**Table 19. Output Power Requirements from §15.407**

§15.407(a) (1): For the band 5.15-5.25 GHz the peak transmit power over the frequency band of operation shall not exceed the lesser 50mW or 4dBm + 10logB, where B is the 26-dB emission bandwidth in MHz.

**Test Procedure:** The transmitter was connected to a calibrated Spectrum analyzer. The EUT was measured at the low, mid and high channels of each band with the data rate that produced the highest output power.

**Test Results:** Equipment complies with the Peak Power Output limits of § 15.401(a) (1).

**Test Engineer(s):** Minh Ly

**Test Date(s):** 07/28/09 - 08/11/09



**Figure 3. Peak Power Output Test Setup**

| 7100 Indoor, Port 1 |                 |      |                             |
|---------------------|-----------------|------|-----------------------------|
| Mode                | Frequency (MHz) |      | Measured Output Power (dBm) |
| 802.11a             | UNII-1          | 5180 | 15.55                       |
|                     |                 | 5240 | 14.63                       |
| 802.11n 20MHz       | UNII-1          | 5180 | 10.46                       |
|                     |                 | 5240 | 11.90                       |
| 802.11n 40MHz       | UNII-1          | 5190 | 11.37                       |
|                     |                 | 5230 | 11.68                       |

Table 20. RF Power Output, Test Results, Port 1

| 7100 Indoor, Port 2 |                 |      |                             |
|---------------------|-----------------|------|-----------------------------|
| Mode                | Frequency (MHz) |      | Measured Output Power (dBm) |
| 802.11n 20MHz       | UNII-1          | 5180 | 11.37                       |
|                     |                 | 5240 | 11.22                       |
| 802.11n 40MHz       | UNII-1          | 5190 | 11.73                       |
|                     |                 | 5230 | 11.97                       |

Table 21. RF Power Output, Test Results, Port 2

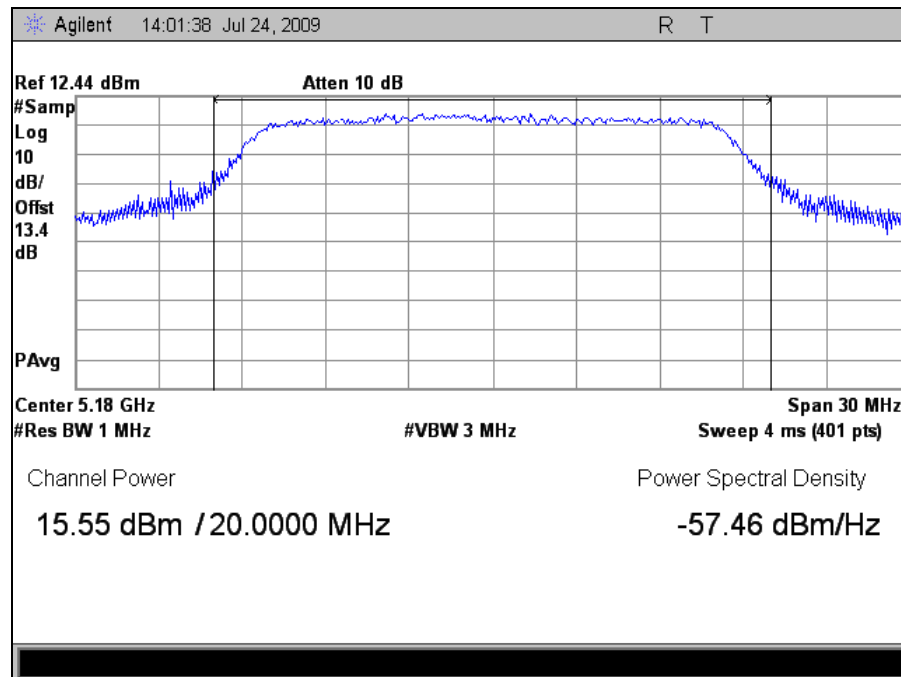
| 7100 Indoor, Port 3 |                 |      |                             |
|---------------------|-----------------|------|-----------------------------|
| Mode                | Frequency (MHz) |      | Measured Output Power (dBm) |
| 802.11n 20MHz       | UNII-1          | 5180 | 11.34                       |
|                     |                 | 5240 | 12.22                       |
| 802.11n 40MHz       | UNII-1          | 5190 | 11.06                       |
|                     |                 | 5230 | 11.16                       |

Table 22. RF Power Output, Test Results, Port 3

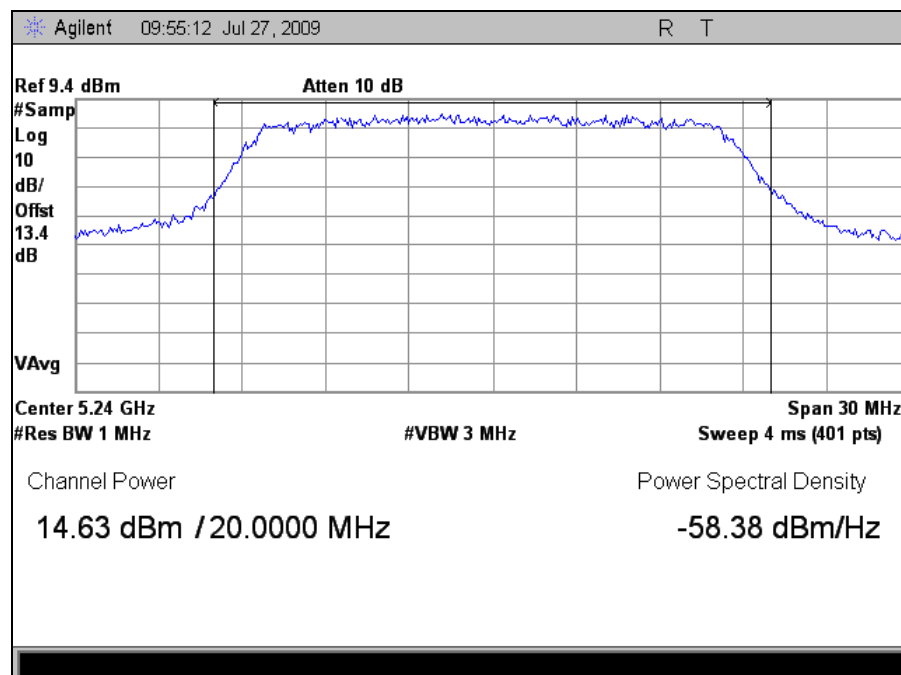
| 7100 Indoor, Sum Power (n mode) |                 |      |        |        |        |                 |
|---------------------------------|-----------------|------|--------|--------|--------|-----------------|
| Mode                            | Frequency (MHz) |      | Port 1 | Port 2 | Port 3 | Sum Power (dBm) |
| 802.11n 20MHz                   | UNII-1          | 5180 | 10.46  | 11.37  | 11.34  | 15.84           |
|                                 |                 | 5240 | 11.9   | 11.22  | 12.22  | 16.57           |
| 802.11n 40MHz                   | UNII-1          | 5190 | 11.37  | 11.73  | 11.06  | 16.16           |
|                                 |                 | 5230 | 11.68  | 11.97  | 11.16  | 16.38           |

Table 23. RF Power Output, Test Results, Sum Power

## RF Power Output, Port 1 802.11a

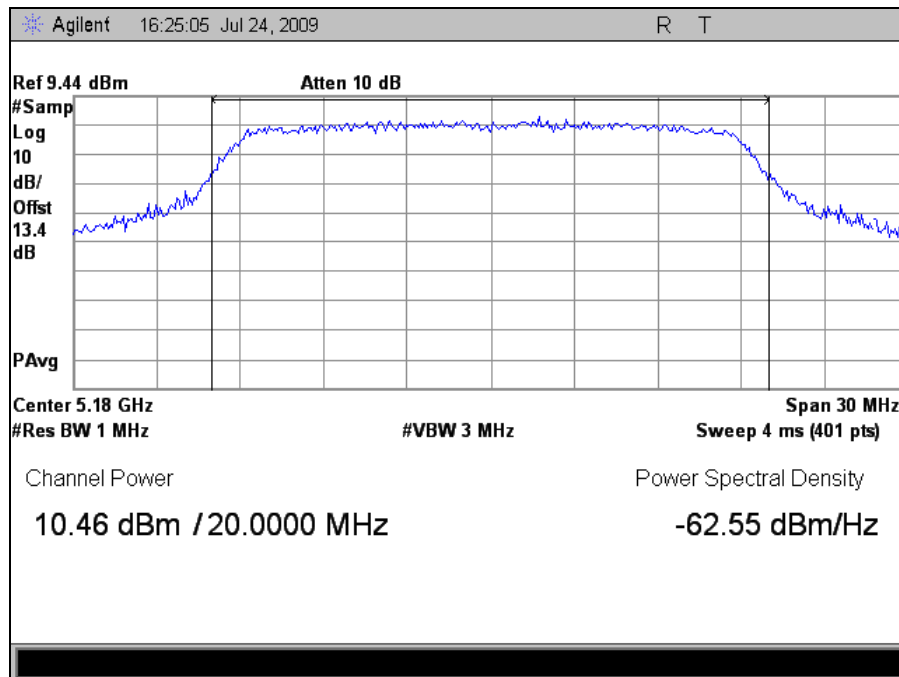


Plot 22. RF Power Output, Port 1, 802.11a, 5180 MHz

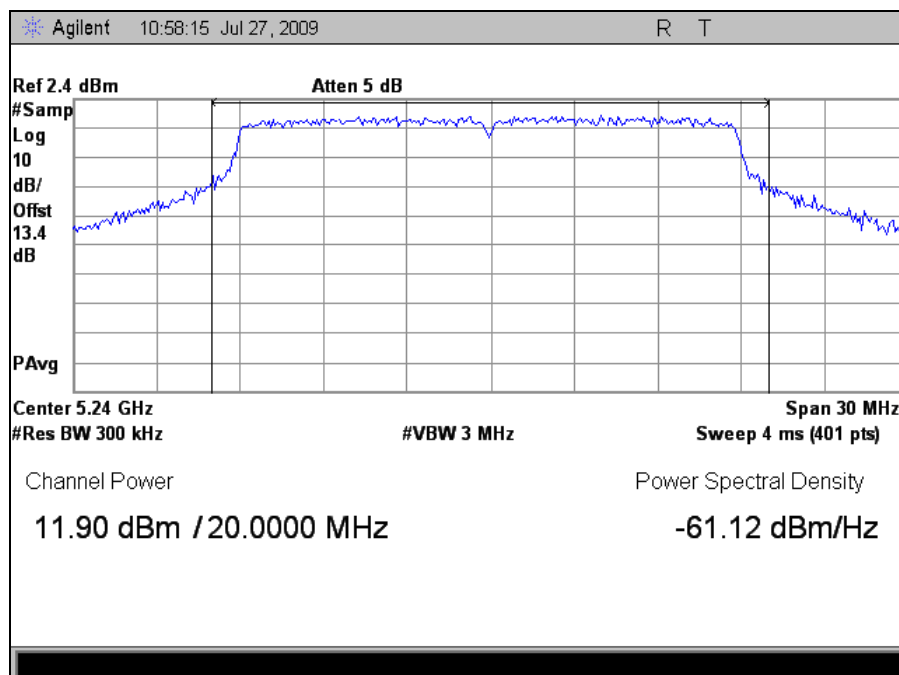


Plot 23. RF Power Output, Port 1, 802.11a, 5240 MHz

## RF Power Output, Port 1, 802.11n 20MHz

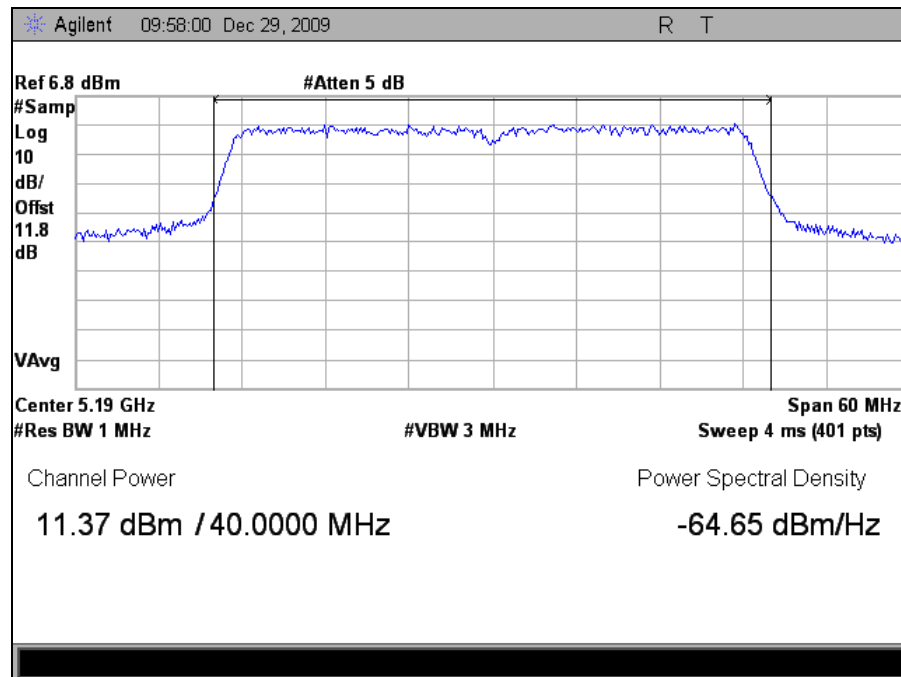


Plot 24. RF Power Output, Port 1, 802.11n 20MHz, 5180 MHz

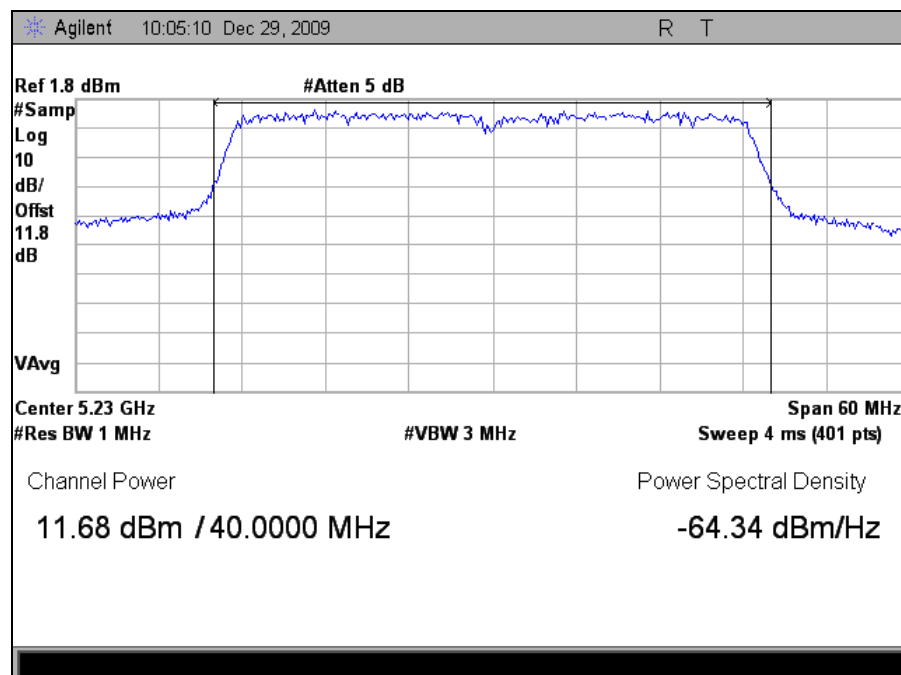


Plot 25. RF Power Output, Port 1, 802.11n 20MHz, 5240 MHz

## RF Power Output, Port 1 802.11n 40MHz

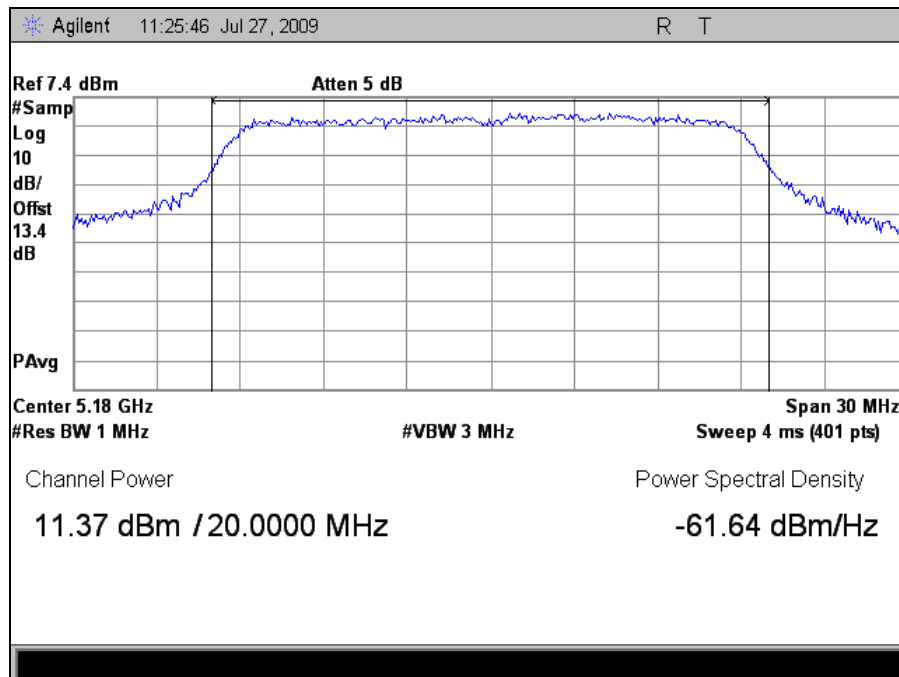


Plot 26. RF Power Output, Port 1, 802.11n 40MHz, 5190 MHz

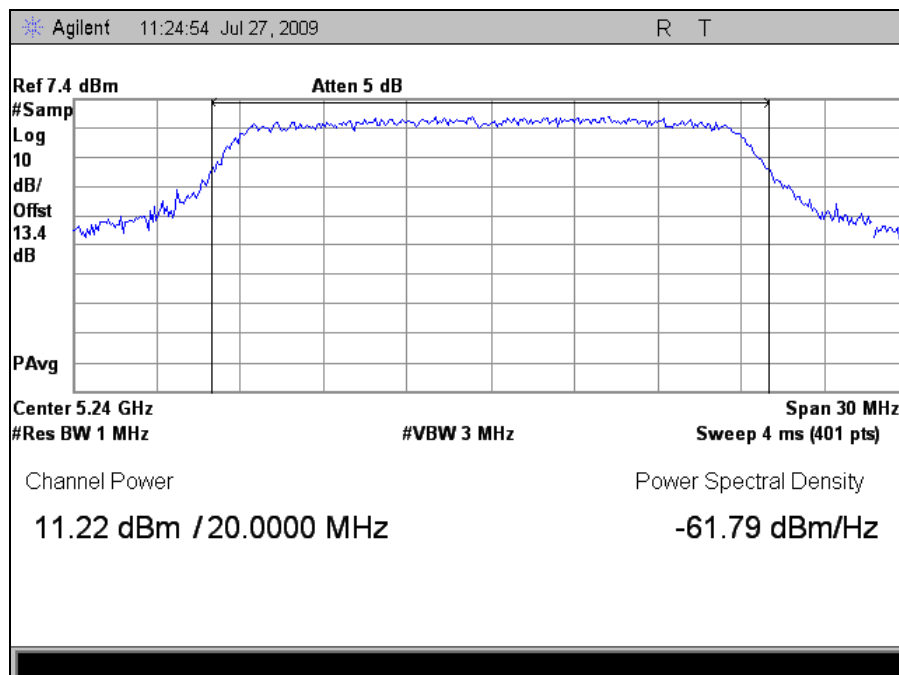


Plot 27. RF Power Output, Port 1, 802.11n 40MHz, 5230 MHz

## RF Power Output, Port 2, 802.11n 20MHz

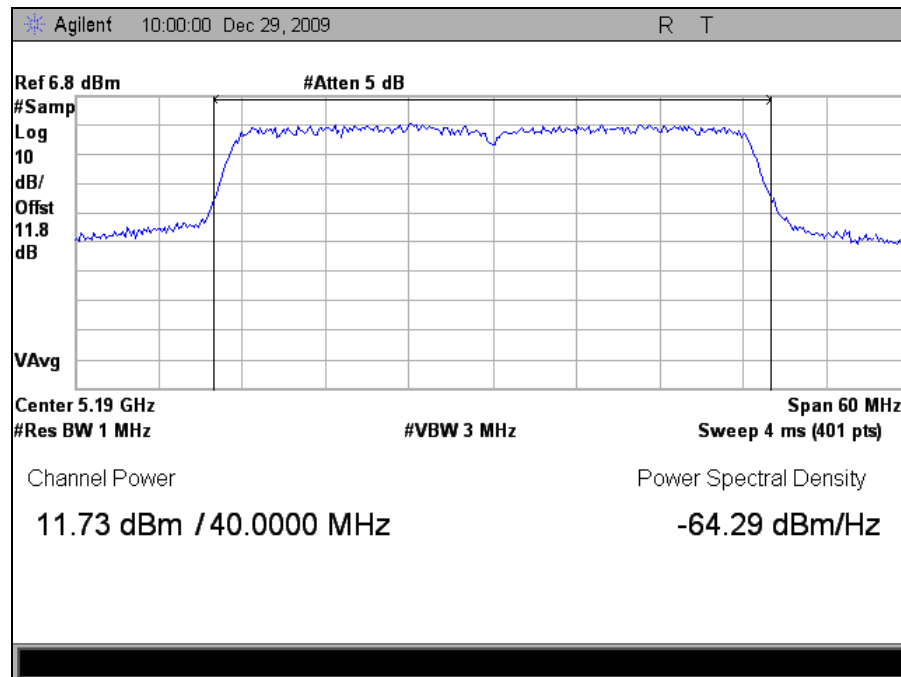


Plot 28. RF Power Output, Port 2, 802.11n 20MHz, 5180 MHz

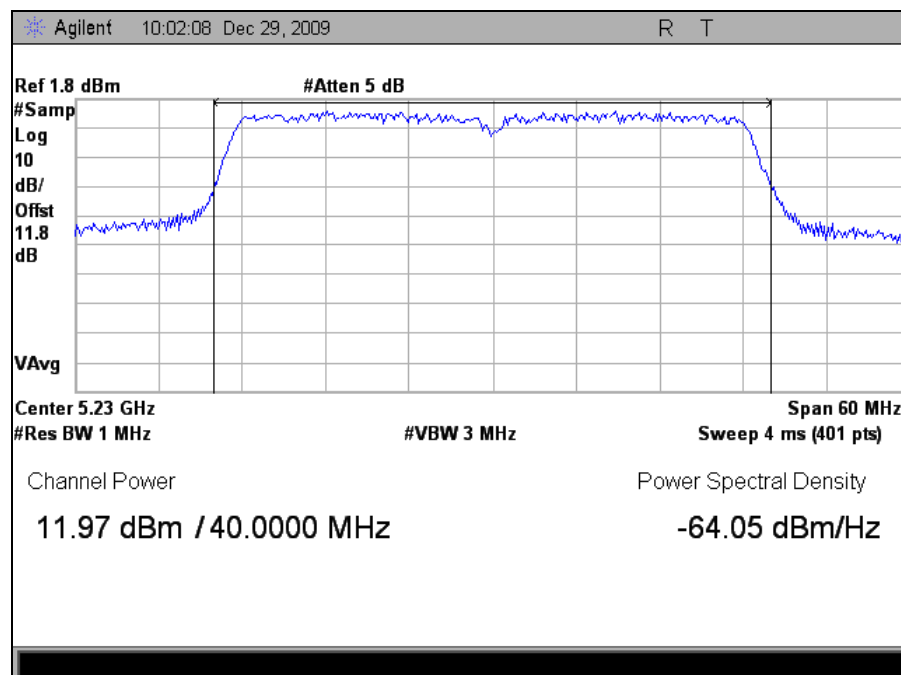


Plot 29. RF Power Output, Port 2, 802.11n 20MHz, 5240 MHz

## RF Power Output, Port 2, 802.11n 40MHz



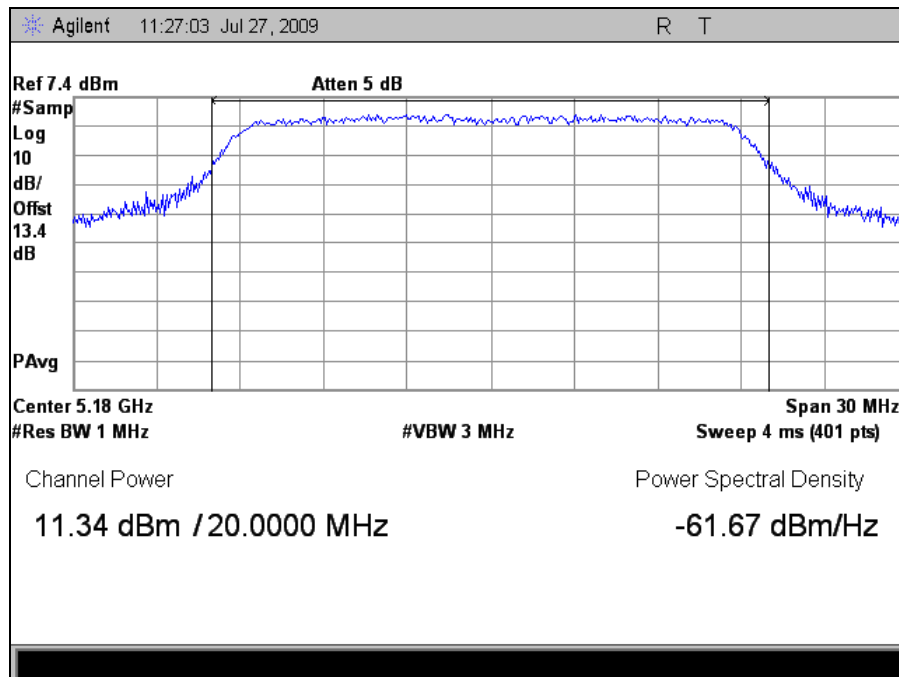
Plot 30. RF Power Output, Port 2, 802.11n 40MHz, 5190 MHz



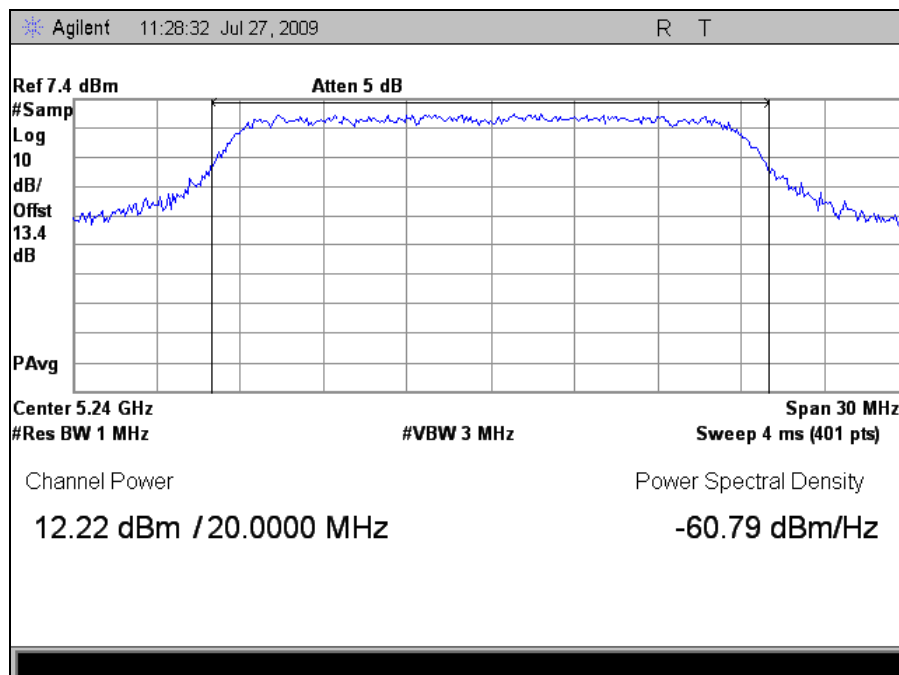
Plot 31. RF Power Output, Port 2, 802.11n 40MHz, 5230 MHz



## RF Power Output, Port 3, 802.11n 20MHz

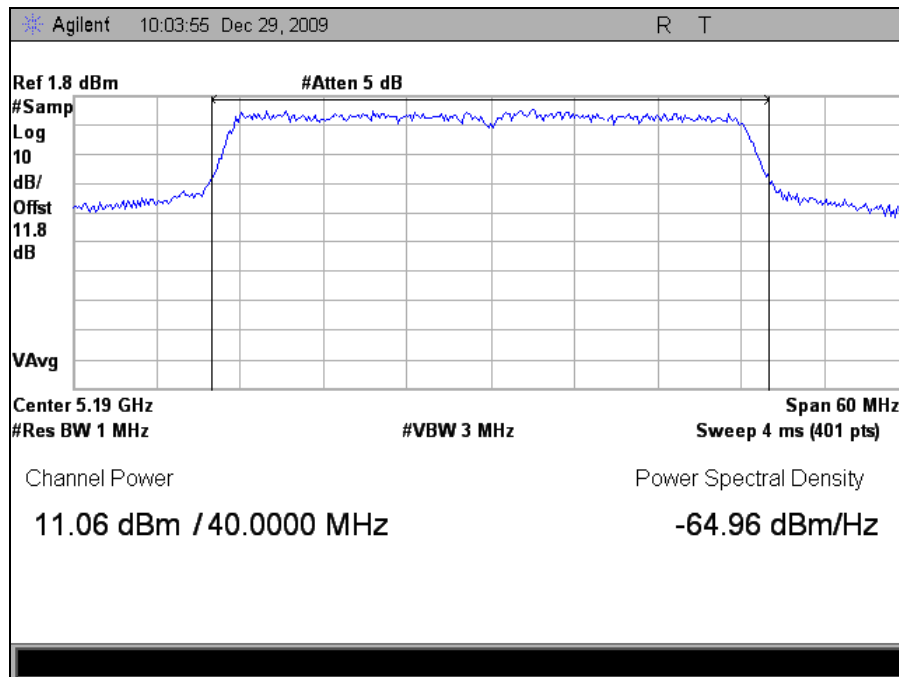


Plot 32. RF Power Output, Port 3, 802.11n 20MHz, 5180 MHz

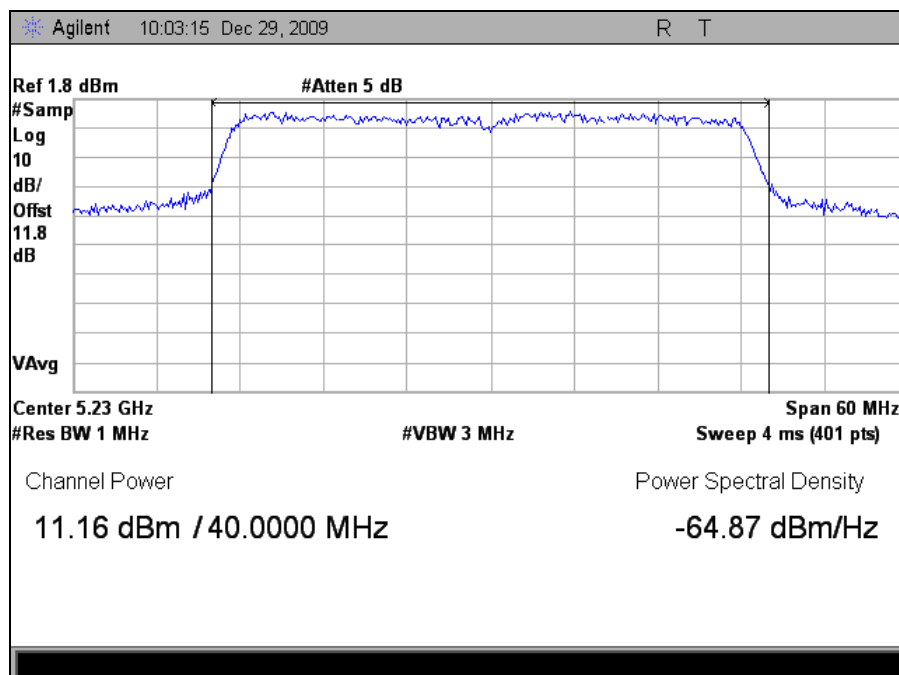


Plot 33. RF Power Output, Port 3, 802.11n 20MHz, 5240 MHz

## RF Power Output, Port 3, 802.11n 40MHz



Plot 34. RF Power Output, Port 3, 802.11n 40MHz, 5190 MHz



Plot 35. RF Power Output, Port 3, 802.11n 40MHz, 5230 MHz

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.407(a)(1), (a)(2) Peak Power Spectral Density

**Test Requirements:** § 15.407(a)(1), (a)(2): For digitally modulated systems, the conducted peak power spectral density from the intentional radiator to the antenna shall not be greater than 4dBm/MHz in the frequency band 5.15-5.25 GHz and 11dBm/MHz in the frequency band 5.25-5.35GHz.

**Test Procedure:** The transmitter was connected directly to a Spectrum Analyzer through an attenuator. The power level was set to the maximum level on the EUT. The RBW was set to 1MHz and the VBW was set to 3MHz. The method of measurement #2 from the FCC Public Notice CA 02-2138 was used.

**Test Results:** Equipment complies with the peak power spectral density limits of § 15.407(a)(1), (a)(2). The peak power spectral density was determined from plots on the following page(s).

**Test Engineer(s):** Minh Ly

**Test Date(s):** 07/28/09 – 08/11/09



Figure 4. Peak Power Spectral Density Test Setup

| 7100 Indoor Unit, Port 1 |                 |                     |             |             |
|--------------------------|-----------------|---------------------|-------------|-------------|
| Mode                     | Frequency (MHz) | Measured PPSD (dBm) | Limit (dBm) | Margin (dB) |
| 802.11a                  | 5180            | 3.713               | 4           | 0.287       |
|                          | 5240            | 3.614               | 4           | 0.386       |
| 802.11n 20MHz            | 5180            | -0.955              | 4           | 4.955       |
|                          | 5240            | -1.047              | 4           | 5.047       |
| 802.11n 40MHz            | 5190            | -1.033              | 4           | 5.033       |
|                          | 5230            | -0.996              | 4           | 4.996       |

Table 24. Peak Power Spectral Density, Test Results, Port 1

| 7100 Indoor Unit, Port 2 |                 |                     |             |             |
|--------------------------|-----------------|---------------------|-------------|-------------|
| Mode                     | Frequency (MHz) | Measured PPSD (dBm) | Limit (dBm) | Margin (dB) |
| 802.11n 20MHz            | 5180            | -0.913              | 4           | 4.913       |
|                          | 5240            | -1.1                | 4           | 5.1         |
| 802.11n 40MHz            | 5190            | -1.095              | 4           | 5.095       |
|                          | 5230            | -0.834              | 4           | 4.834       |

Table 25. Peak Power Spectral Density, Test Results, Port 2

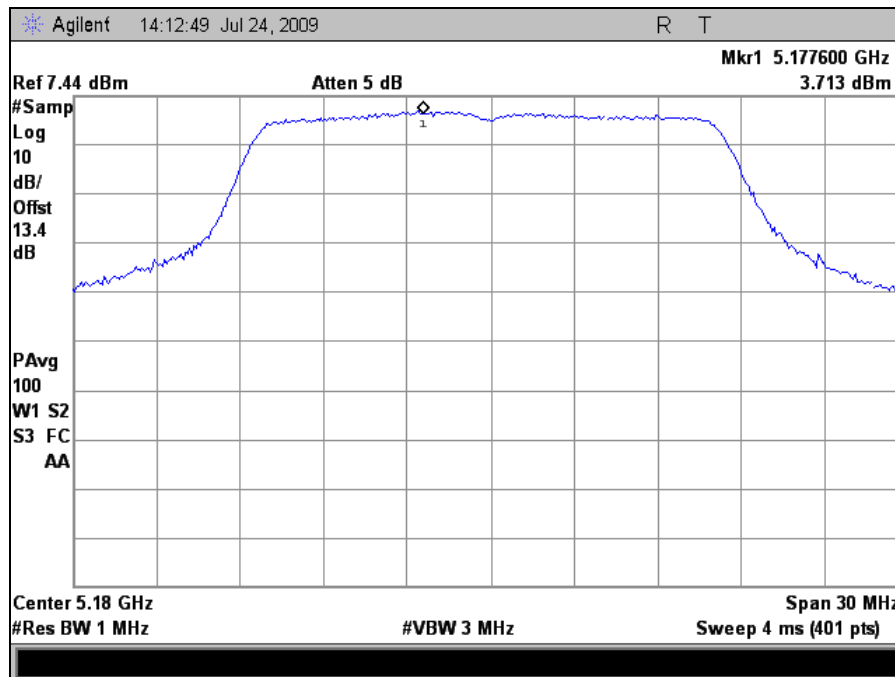
| 7100 Indoor Unit, Port 3 |                 |                     |             |             |
|--------------------------|-----------------|---------------------|-------------|-------------|
| Mode                     | Frequency (MHz) | Measured PPSD (dBm) | Limit (dBm) | Margin (dB) |
| 802.11n 20MHz            | 5180            | -1.145              | 4           | 5.145       |
|                          | 5240            | -0.571              | 4           | 4.571       |
| 802.11n 40MHz            | 5190            | -0.375              | 4           | 4.375       |
|                          | 5230            | -0.909              | 4           | 4.909       |

Table 26. Peak Power Spectral Density, Test Results, Port 3

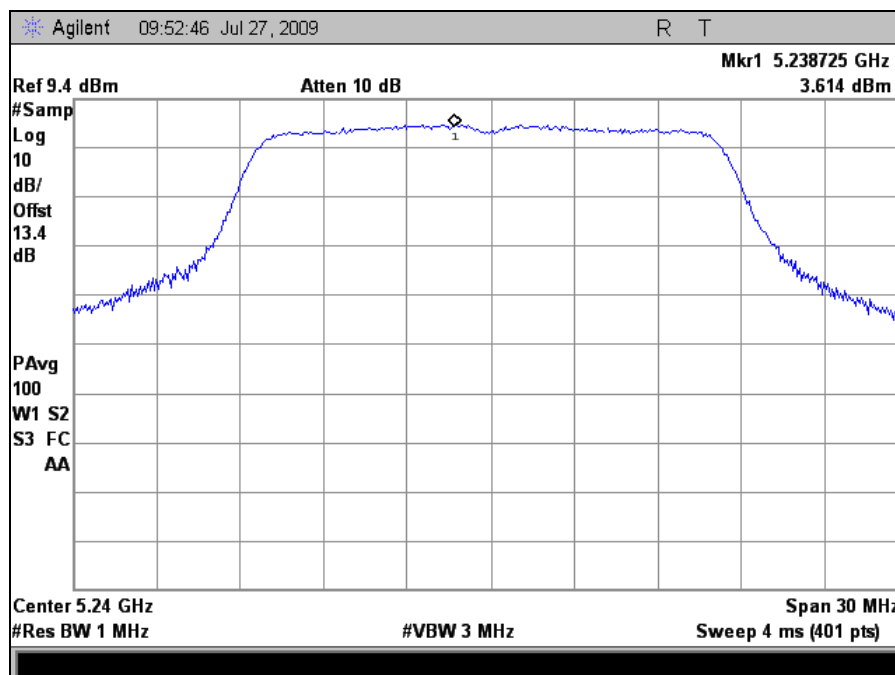
| 7100 Indoor Unit, Combined Ports |                 |                     |             |             |
|----------------------------------|-----------------|---------------------|-------------|-------------|
| Mode                             | Frequency (MHz) | Measured PPSD (dBm) | Limit (dBm) | Margin (dB) |
| 802.11n 20MHz                    | 5180            | 3.861               | 4           | 0.139       |
|                                  | 5240            | 3.862               | 4           | 0.138       |
| 802.11n 40MHz                    | 5190            | 3.873               | 4           | 0.127       |
|                                  | 5230            | 3.649               | 4           | 0.351       |

Table 27. Peak Power Spectral Density, Test Results, Combined Ports

## Peak Power Spectral Density, Port 1, 802.11a

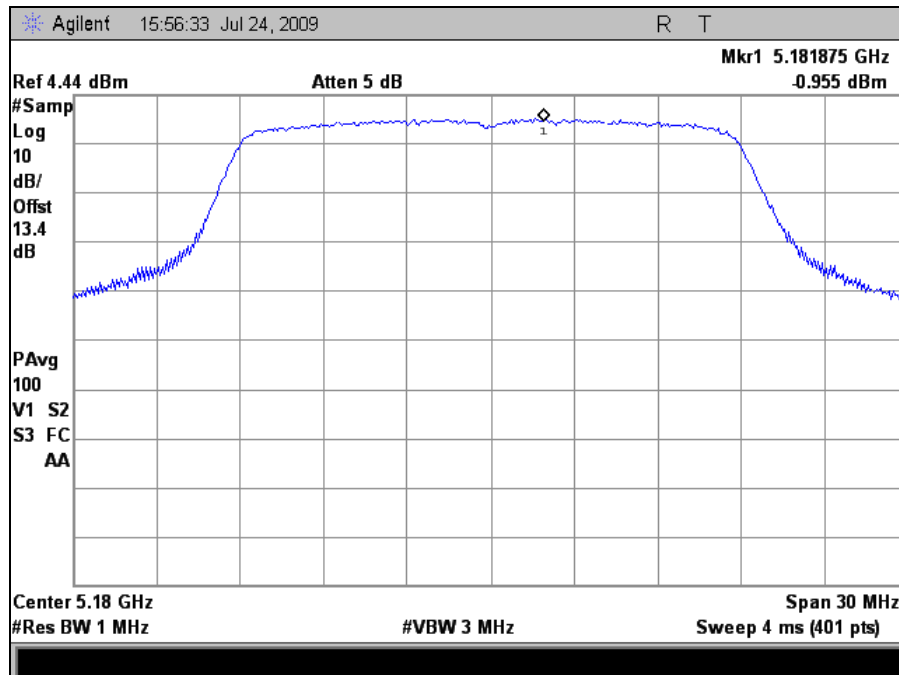


Plot 36. PPSD, Port 1, 802.11a, 5180 MHz

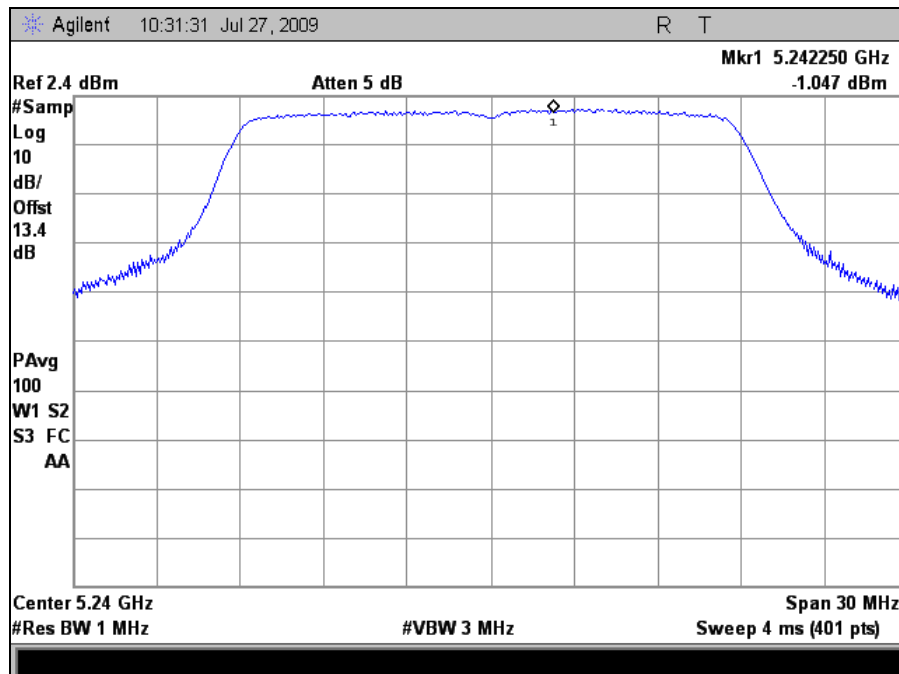


Plot 37. PPSD, Port 1, 802.11a, 5240 MHz

## Peak Power Spectral Density, Port 1, 802.11n 20MHz

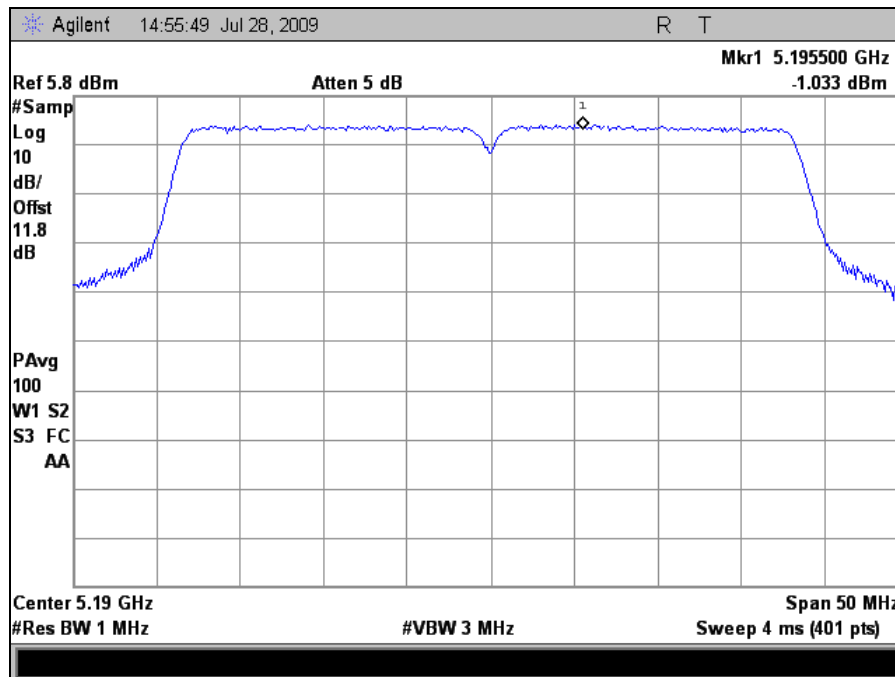


Plot 38. PPSD, \ Port 1, 802.11n 20MHz, 5180 MHz

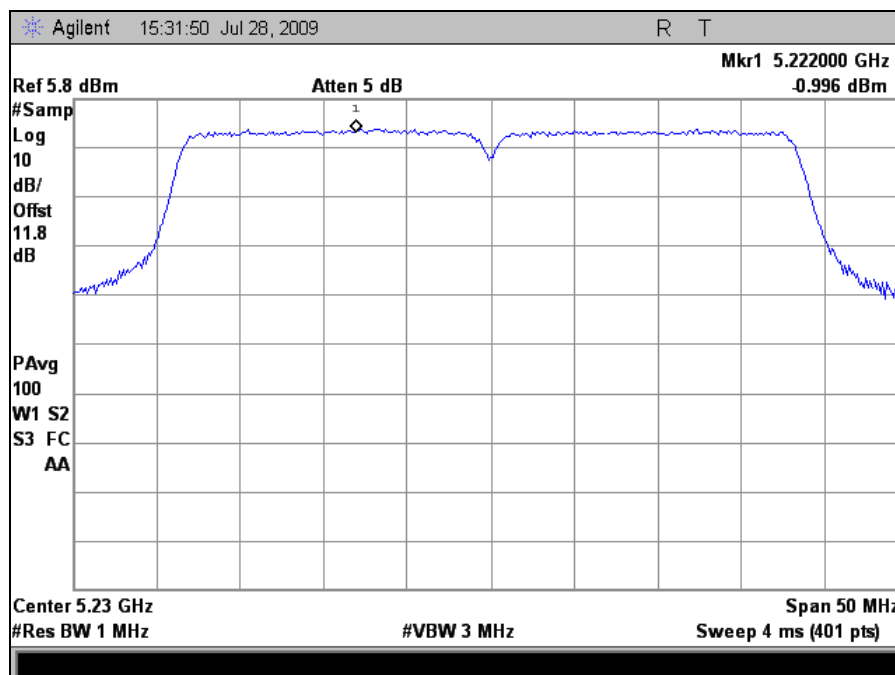


Plot 39. PPSD, Port 1, 802.11n 20MHz, 5240 MHz

## Peak Power Spectral Density, Port 1, 802.11n 40MHz

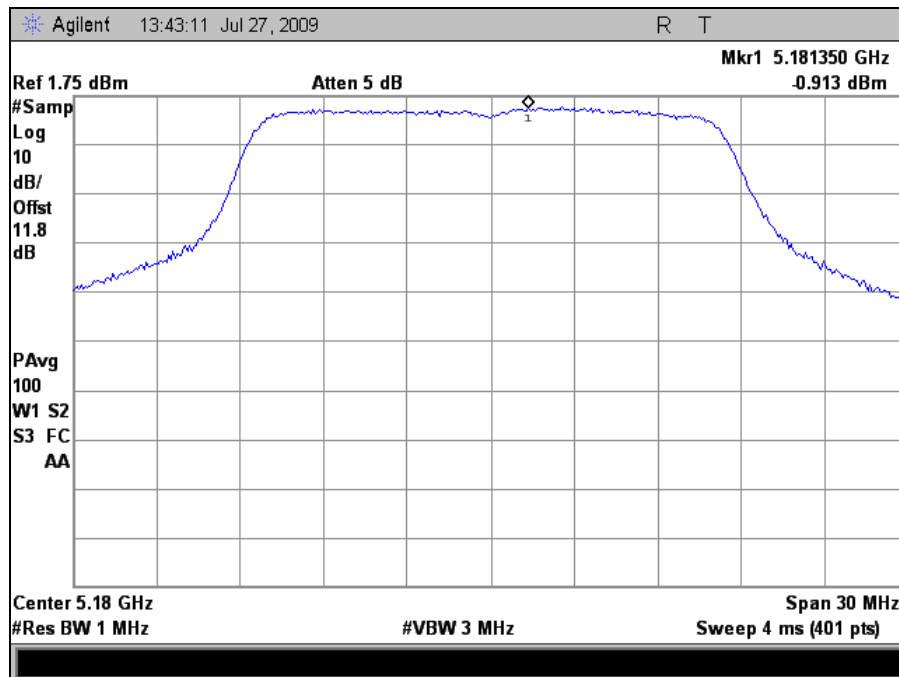


Plot 40. PSD, Port 1, 802.11n 40MHz, 5190 MHz

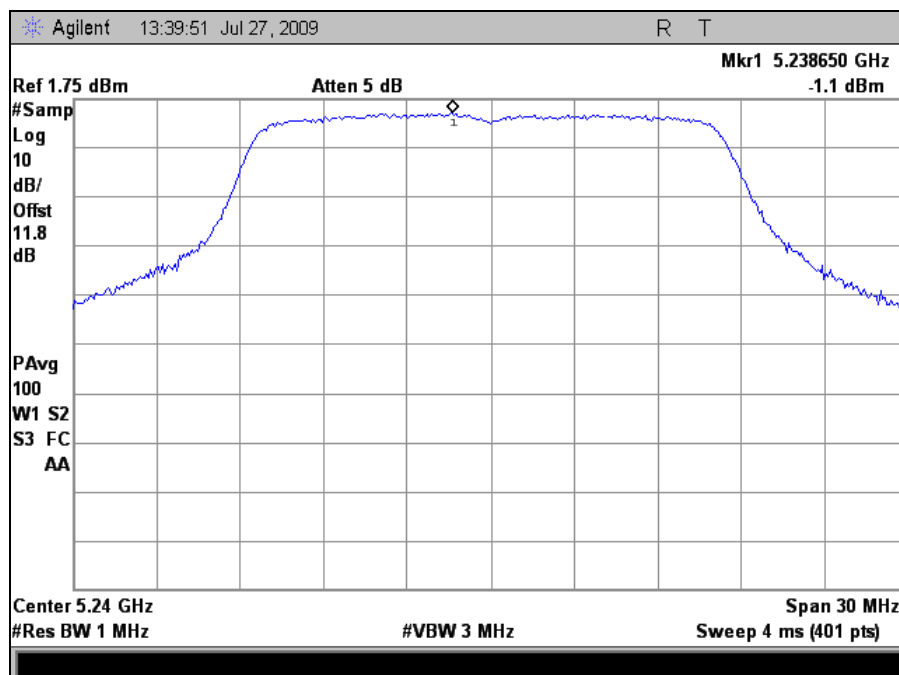


Plot 41. PSD, Port 1, 802.11n 40MHz, 5230 MHz

## Peak Power Spectral Density, Port 2, 802.11n 20MHz



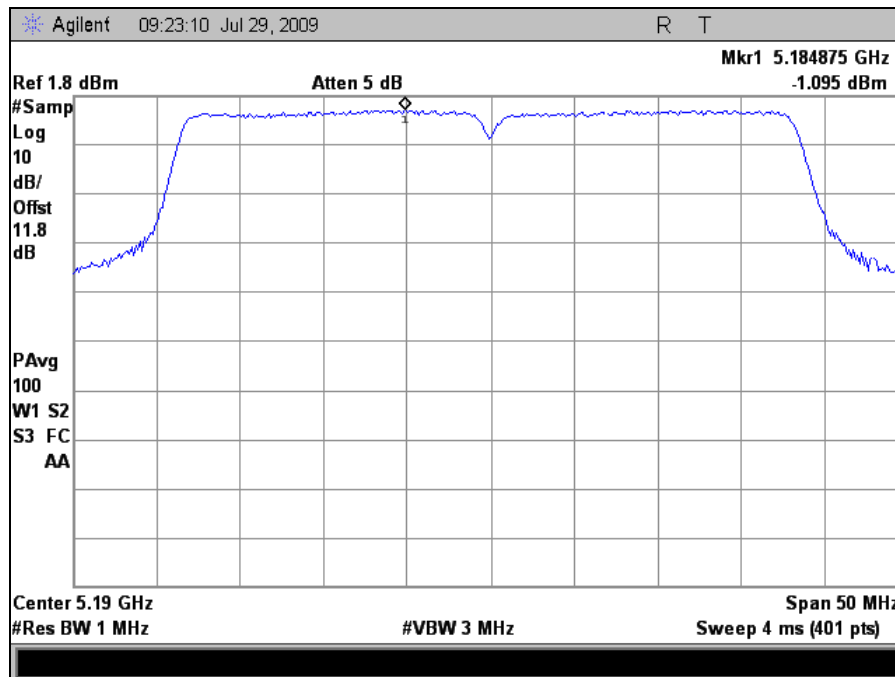
Plot 42. PPSD, Port 2, 802.11n 20MHz, 5180 MHz



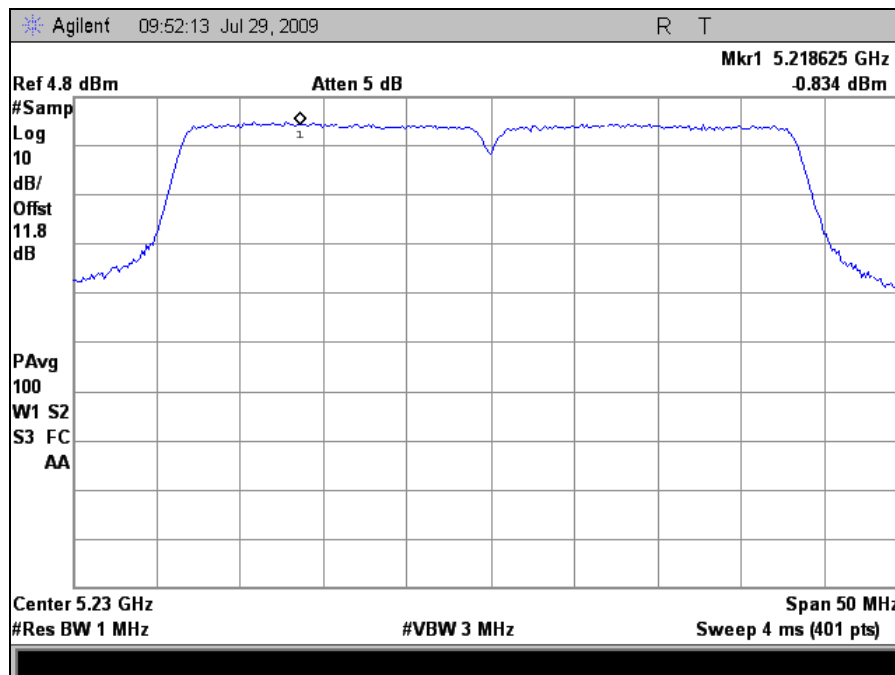
Plot 43. PPSD, Port 2, 802.11n 20MHz, 5240 MHz



## Peak Power Spectral Density, Port 2, 802.11n 40MHz

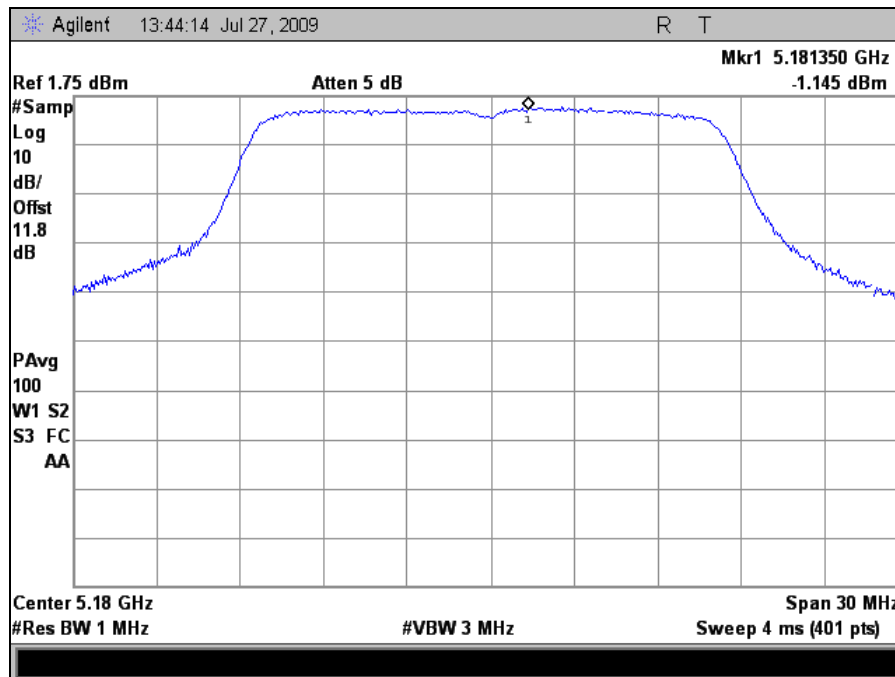


Plot 44. PPSD, Port 2, 802.11n 40MHz, 5190 MHz

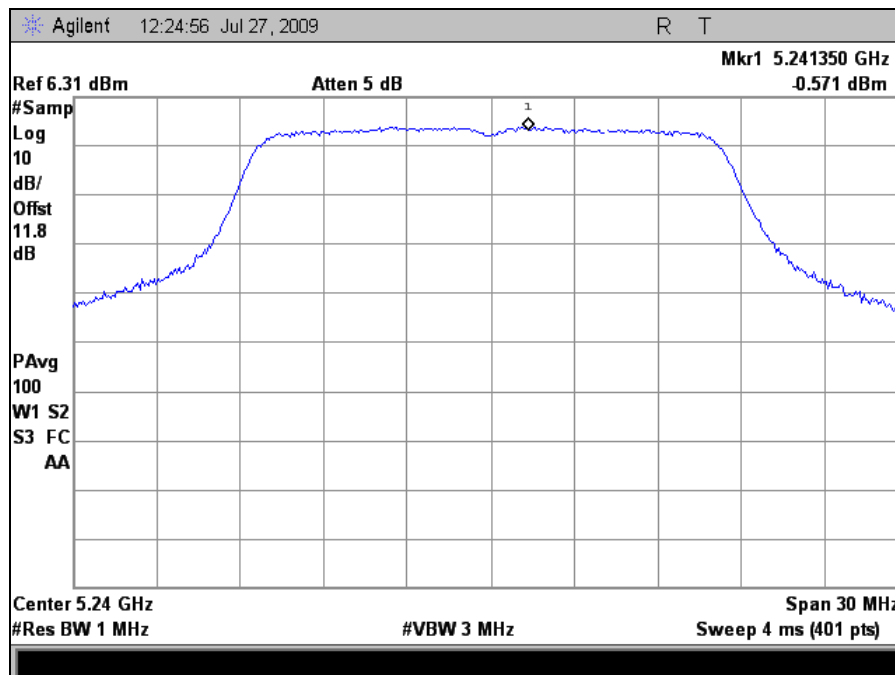


Plot 45. PPSD, Port 2, 802.11n 40MHz, 5230 MHz

## Peak Power Spectral Density, Port 3, 802.11n 20MHz

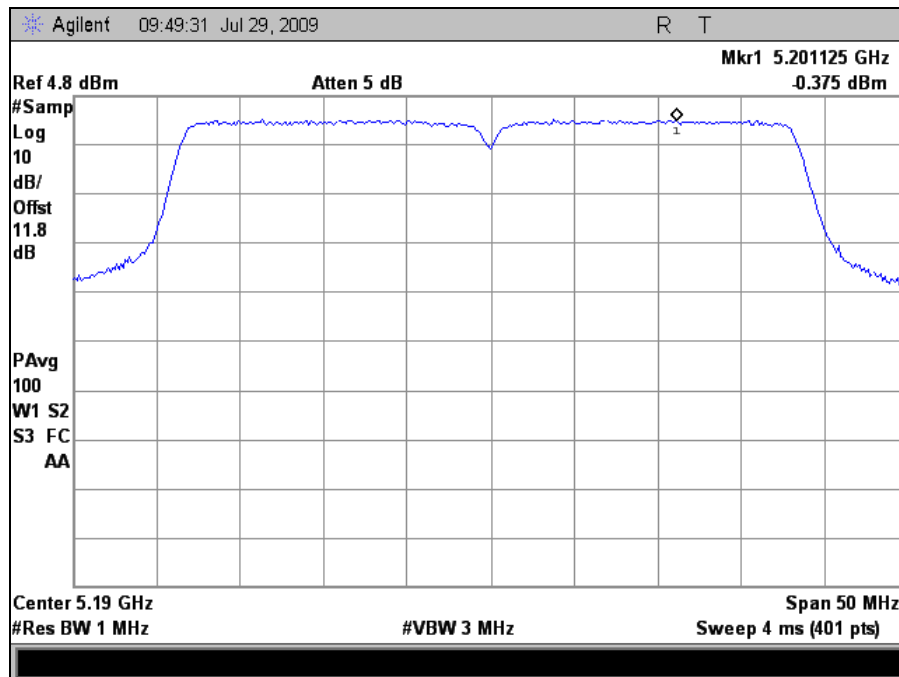


Plot 46. PSD, Port 3, 802.11n 20MHz, 5180 MHz

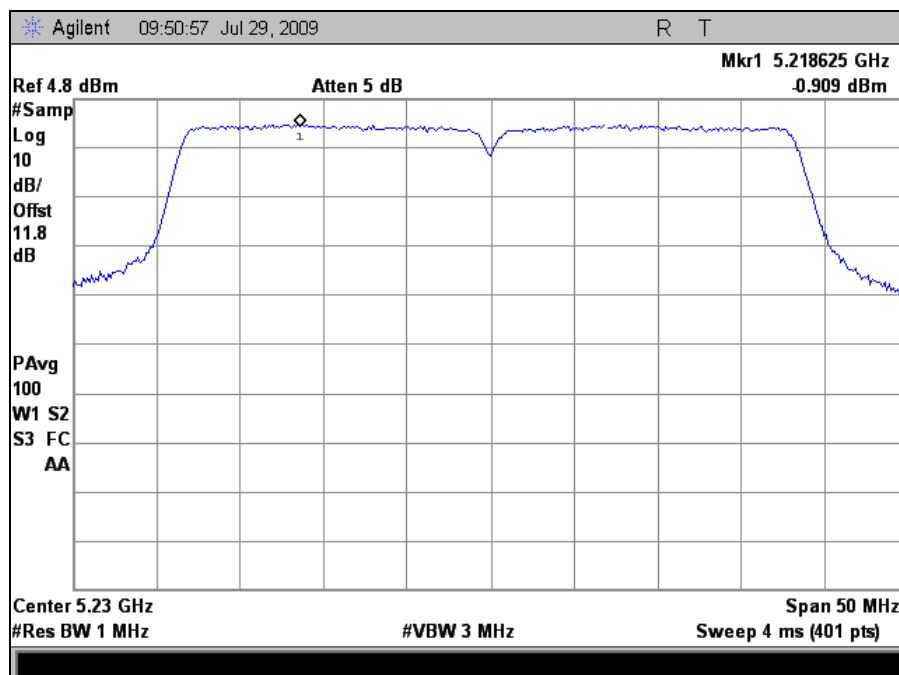


Plot 47. PSD, Port 3, 802.11n 20MHz, 5240 MHz

## Peak Power Spectral Density, Port 3, 802.11n 40MHz

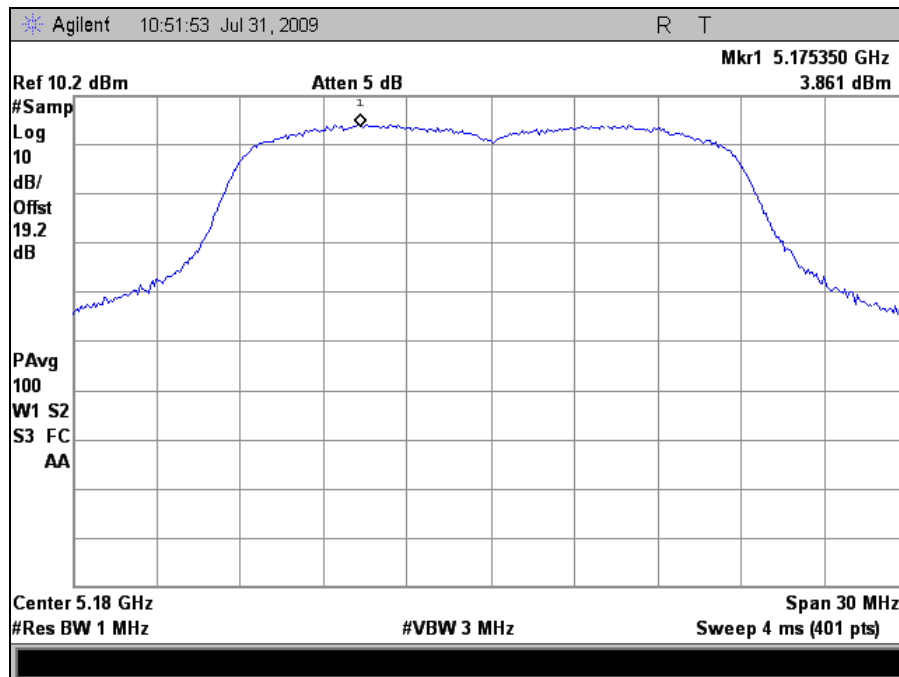


Plot 48. PSD, Port 3, 802.11n 40MHz, 5190 MHz

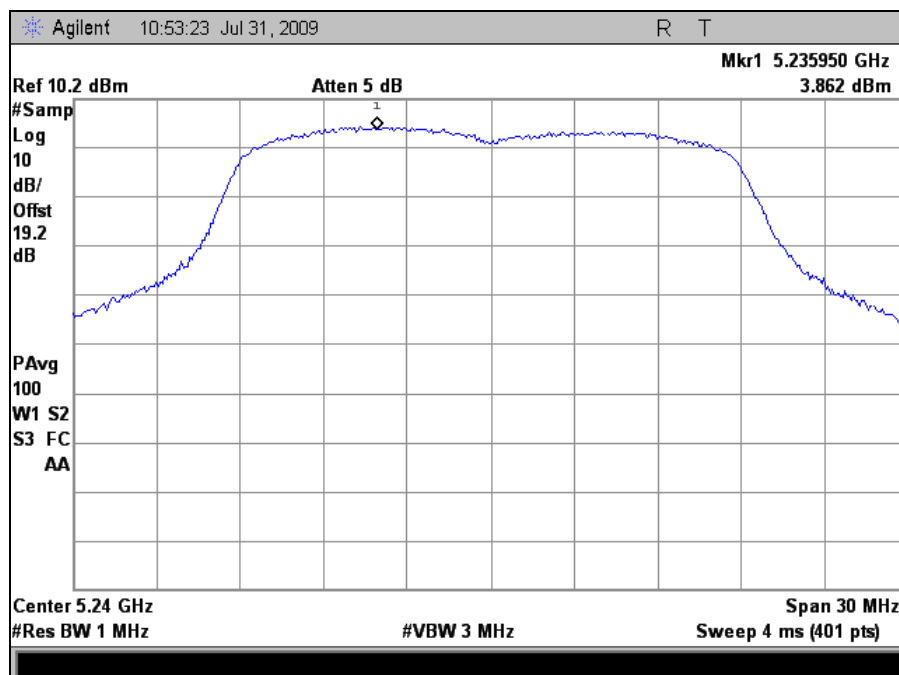


Plot 49. PSD, Port 3, 802.11n 40MHz, 5230 MHz

## Peak Power Spectral Density, Combined Ports, 802.11n 20MHz

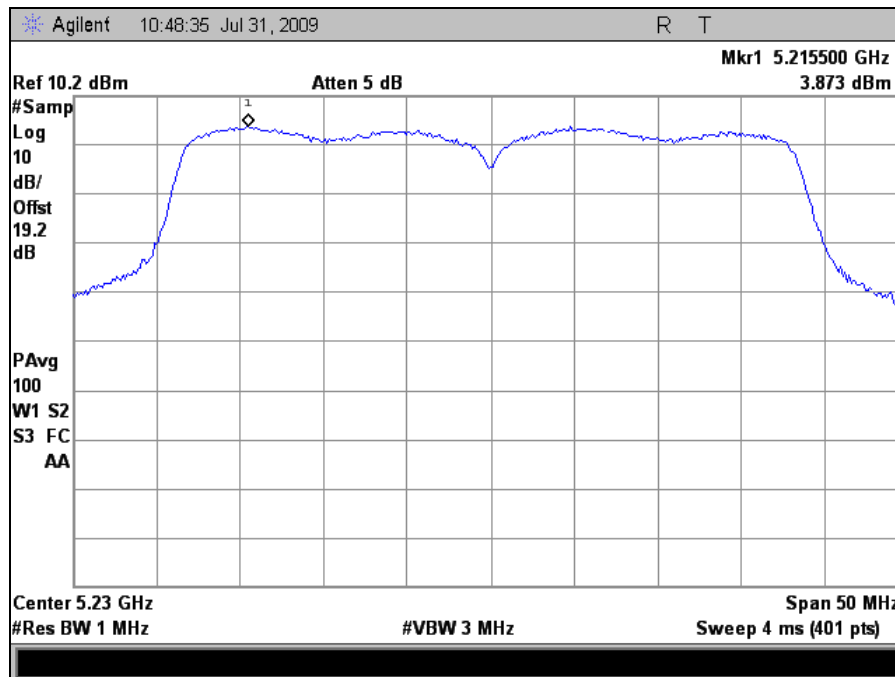


Plot 50. PPSD, Combined Ports, 802.11n 20MHz, 5180 MHz

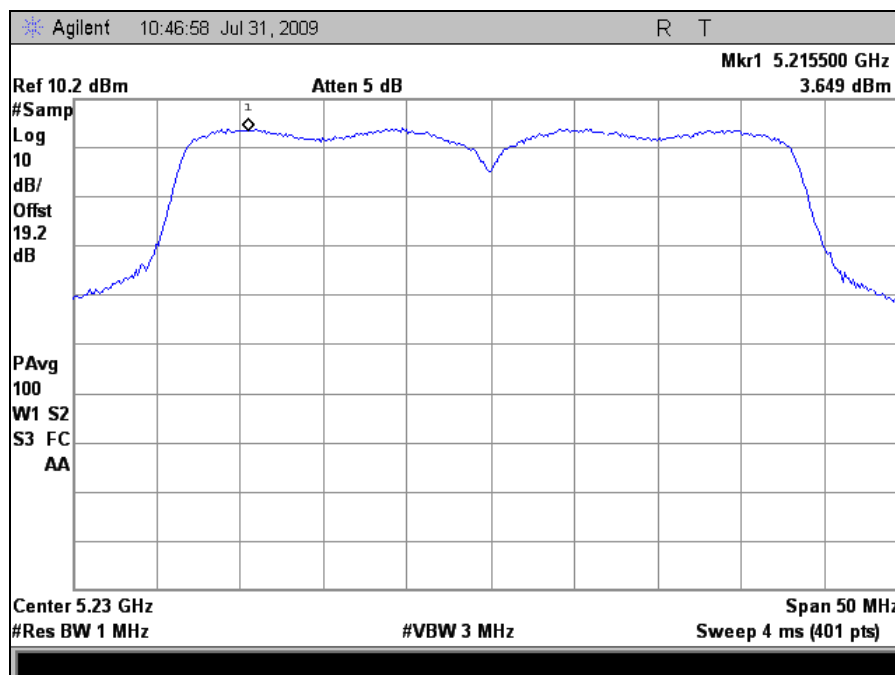


Plot 51. PPSD, Combined Ports, 802.11n 20MHz, 5240 MHz

## Peak Power Spectral Density, Combined Ports, 802.11n 40MHz



Plot 52. PPSD, Combined Ports, 802.11n 40MHz, 5190 MHz



Plot 53. PPSD, Combined Ports, 802.11n 40MHz, 5230 MHz

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.407(a)(6)      Peak Excursion Ratio

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test Requirements:</b> | <b>§ 15.407(a)(6):</b> For digitally modulated systems, the peak excursion of the modulation envelope to the peak transmit power shall not exceed 13dB across any 1MHz bandwidth of the emission bandwidth whichever is less.                                                                                                                                                                                                                                                                                                                                        |
| <b>Test Procedure:</b>    | <p>The method of measurement #2 from the FCC Public Notice CA 02-2138 was used. The EUT was connected directly to the spectrum analyzer through cabling and attenuation. The 1<sup>st</sup> trace on the spectrum analyzer was set to RBW=1MHz, VBW=3MHz. The peak detector mode was used and the trace max held. The 2<sup>nd</sup> trace on the spectrum analyzer was set to a RBW=1MHz, VBW=30 KHz. The detector mode was set to sample detector.</p> <p>The Peak Excursion Ratio was determined from the difference between the maximum found in each trace.</p> |
| <b>Test Results:</b>      | Equipment complies with the peak excursion ratio limits of <b>§ 15.407(a)(6)</b> . The peak excursion ratio was determined from plots on the following page(s).                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Test Engineer(s):</b>  | Minh Ly                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Test Date(s):</b>      | 07/28/09 - 08/11/09                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

| 7100 Indoor Unit, Port 1 |                 |                       |             |             |
|--------------------------|-----------------|-----------------------|-------------|-------------|
| Mode                     | Frequency (MHz) | Excursion Ratio (dBm) | Limit (dBm) | Margin (dB) |
| 802.11a                  | 5180            | 9.667                 | 13          | 3.333       |
|                          | 5240            | 9.006                 | 13          | 3.994       |
| 802.11n 20MHz            | 5180            | 11.09                 | 13          | 1.91        |
|                          | 5240            | 9.562                 | 13          | 3.438       |
| 802.11n 40MHz            | 5190            | 12.72                 | 13          | 0.28        |
|                          | 5230            | 11.58                 | 13          | 1.42        |

Table 28. Peak Excursion Ratio, Test Results, Port 1

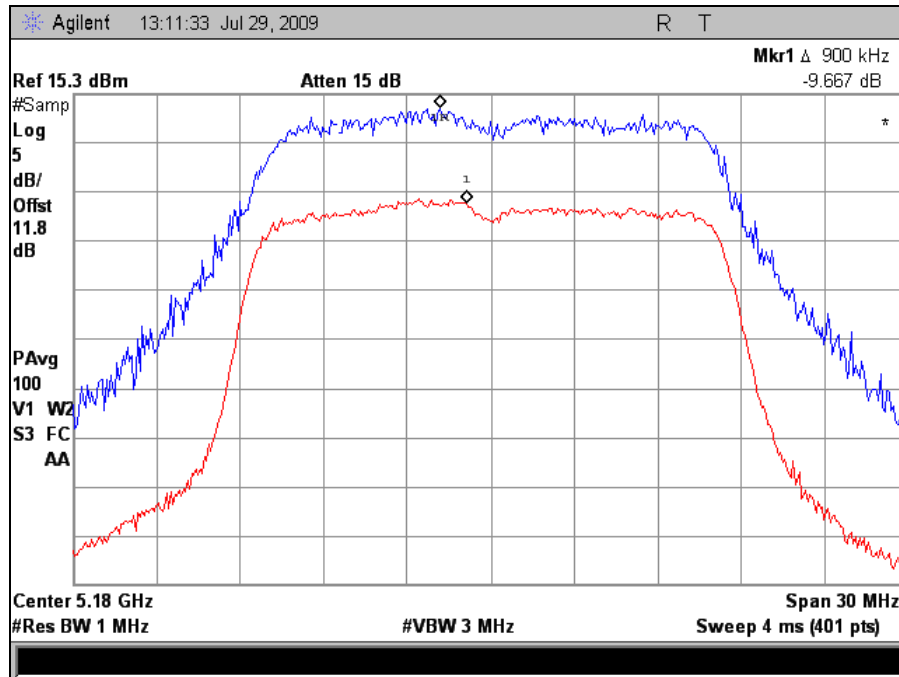
| 7100 Indoor Unit, Port 2 |                 |                       |             |             |
|--------------------------|-----------------|-----------------------|-------------|-------------|
| Mode                     | Frequency (MHz) | Excursion Ratio (dBm) | Limit (dBm) | Margin (dB) |
| 802.11n 20MHz            | 5180            | 10.02                 | 13          | 2.98        |
|                          | 5240            | 10.32                 | 13          | 2.68        |
| 802.11n 40MHz            | 5190            | 11.83                 | 13          | 1.17        |
|                          | 5230            | 12.17                 | 13          | 0.83        |

Table 29. Peak Excursion Ratio, Test Results, Port 2

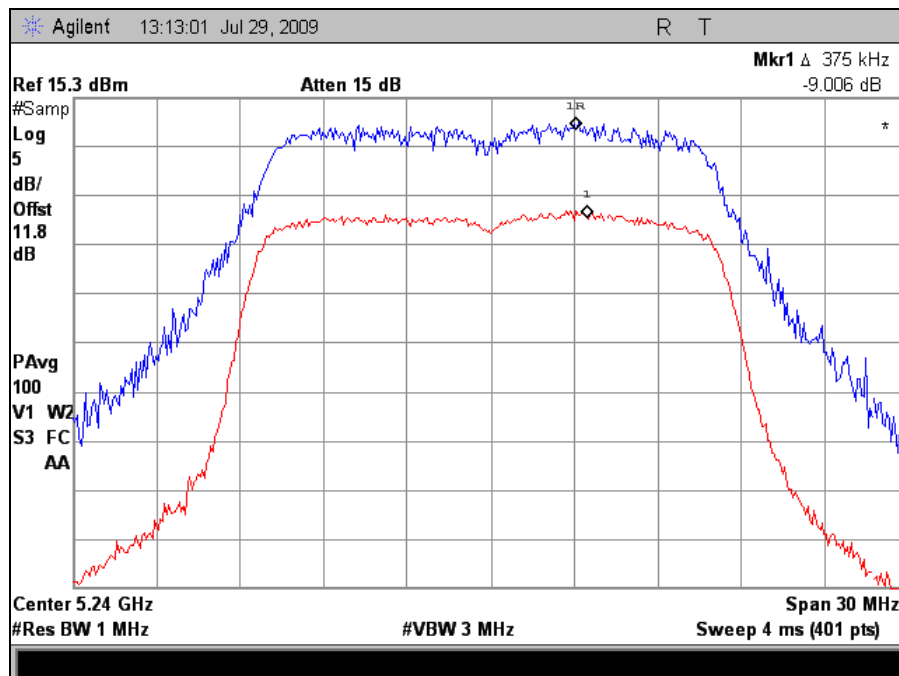
| 7100 Indoor Unit, Port 3 |                 |                       |             |             |
|--------------------------|-----------------|-----------------------|-------------|-------------|
| Mode                     | Frequency (MHz) | Excursion Ratio (dBm) | Limit (dBm) | Margin (dB) |
| 802.11n 20MHz            | 5180            | 9.873                 | 13          | 3.127       |
|                          | 5240            | 11.08                 | 13          | 1.92        |
| 802.11n 40MHz            | 5190            | 12.22                 | 13          | 0.78        |
|                          | 5230            | 12.41                 | 13          | 0.59        |

Table 30. Peak Excursion Ratio, Test Results, Port 3

## Peak Excursion Ratio, Port 1, 802.11a



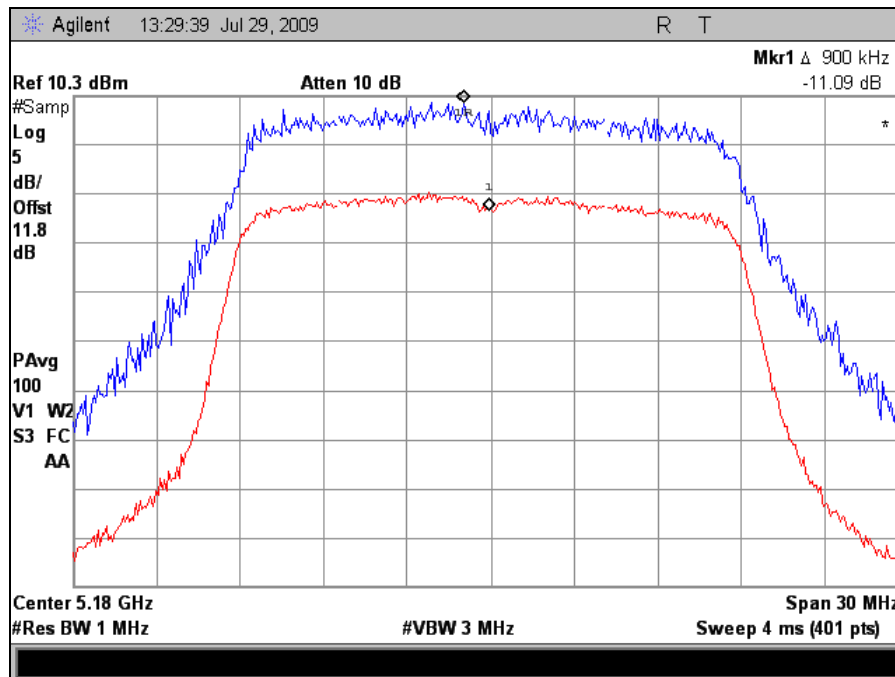
Plot 54. Peak Excursion, Port 1, 802.11a, 5180 MHz



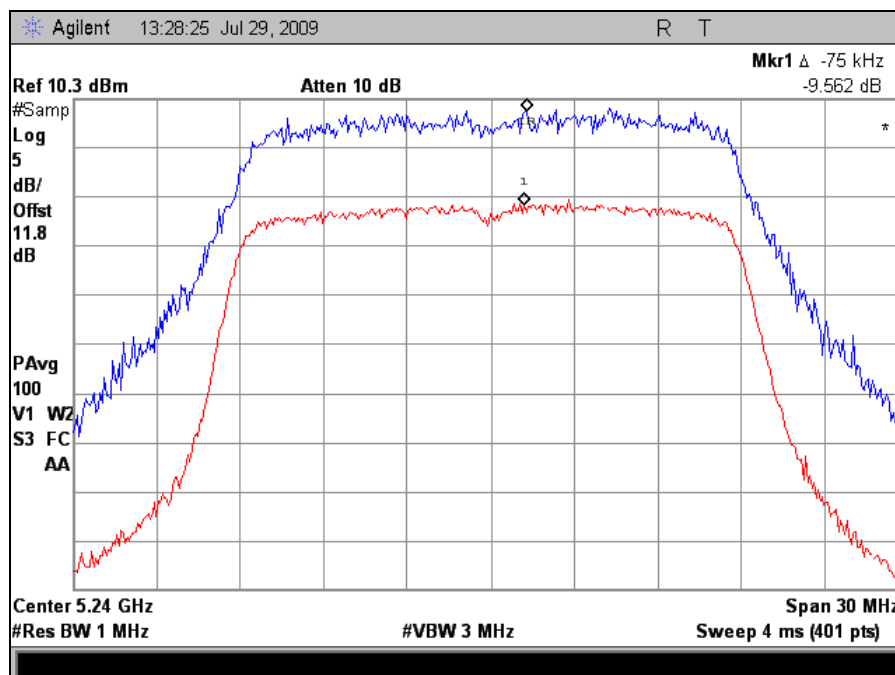
Plot 55. Peak Excursion, Port 1, 802.11a, 5240 MHz



## Peak Excursion Ratio, 7100 Indoor, Port 1, 802.11n 20MHz

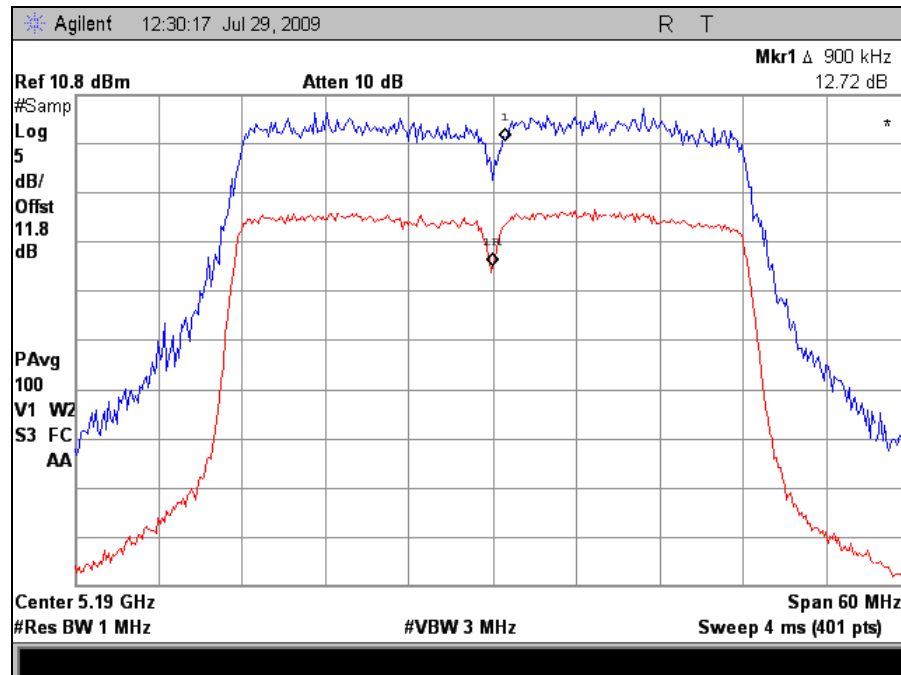


Plot 56. Peak Excursion, Port 1, 802.11n 20MHz, 5180 MHz

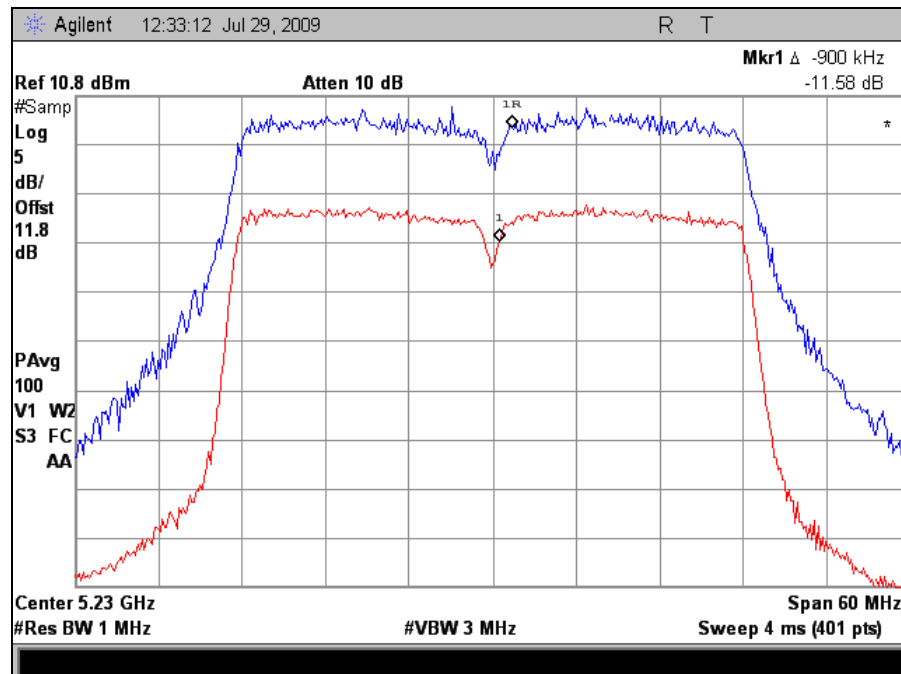


Plot 57. Peak Excursion, Port 1, 802.11n 20MHz, 5240 MHz

## Peak Excursion Ratio, Port 1, 802.11n 40MHz

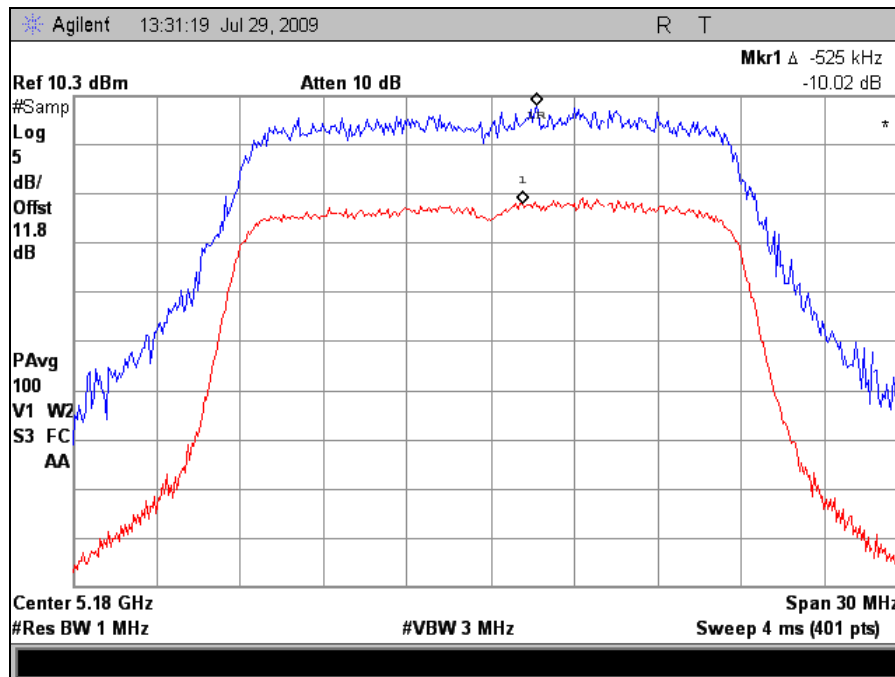


Plot 58. Peak Excursion, Port 1, 802.11n 40MHz, 5190 MHz

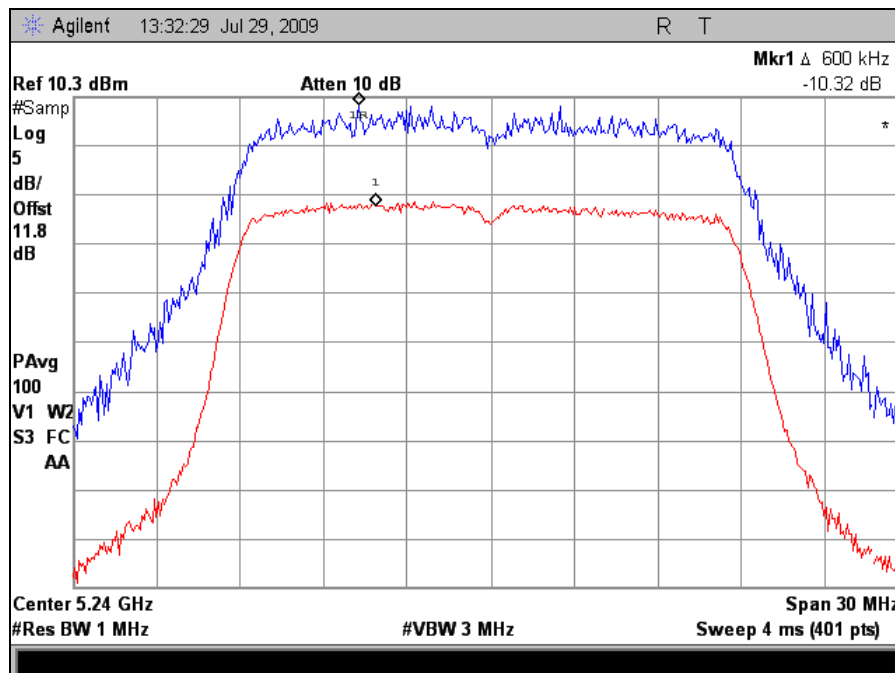


Plot 59. Peak Excursion, Port 1, 802.11n 40MHz, 5230 MHz

## Peak Excursion Ratio, Port 2, 802.11n 20MHz

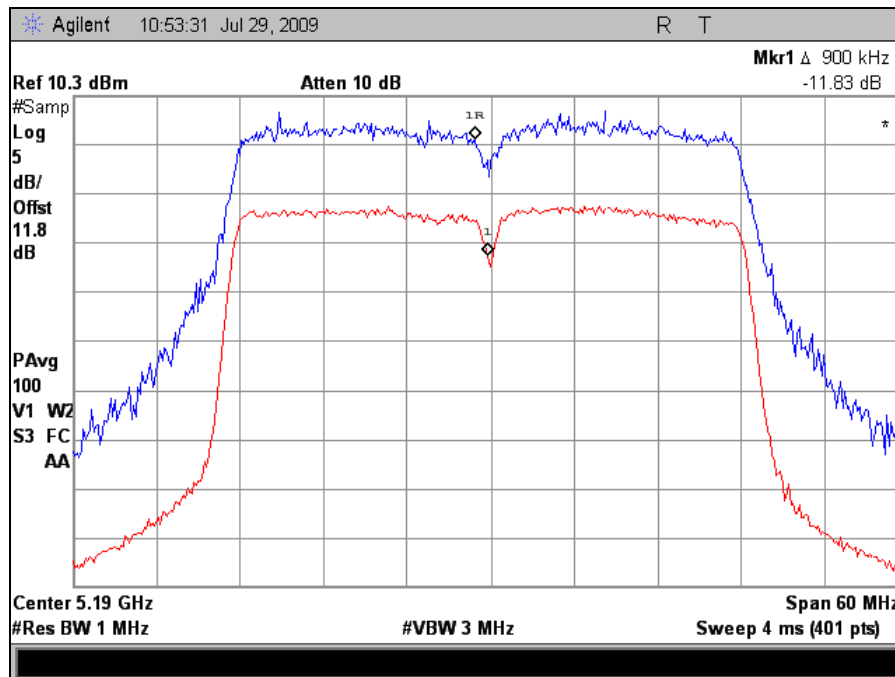


Plot 60. Peak Excursion, Port 2, 802.11n 20MHz, 5180 MHz

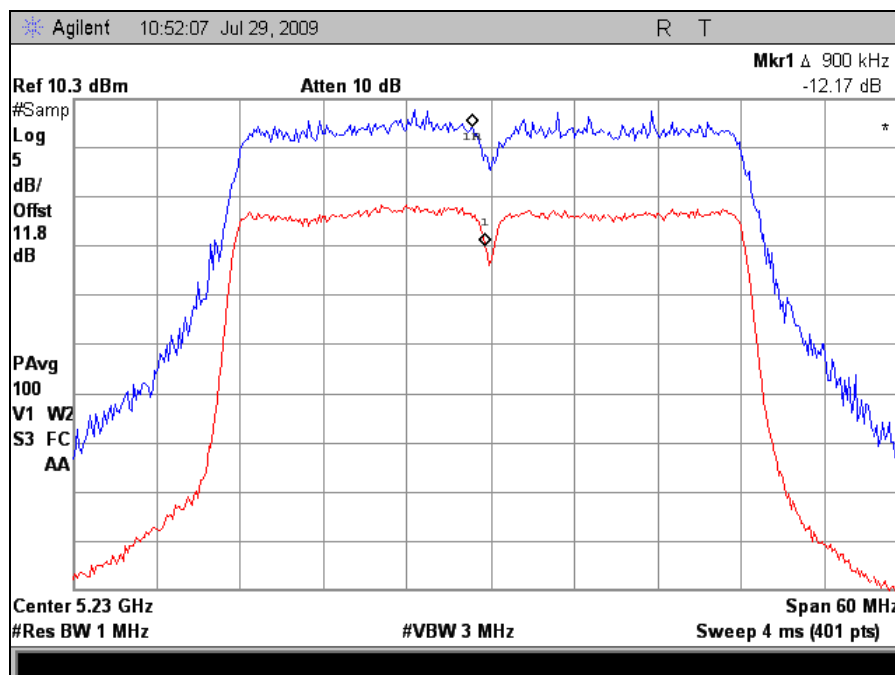


Plot 61. Peak Excursion, Port 2, 802.11n 20MHz, 5240 MHz

## Peak Excursion Ratio, Port 2, 802.11n 40MHz

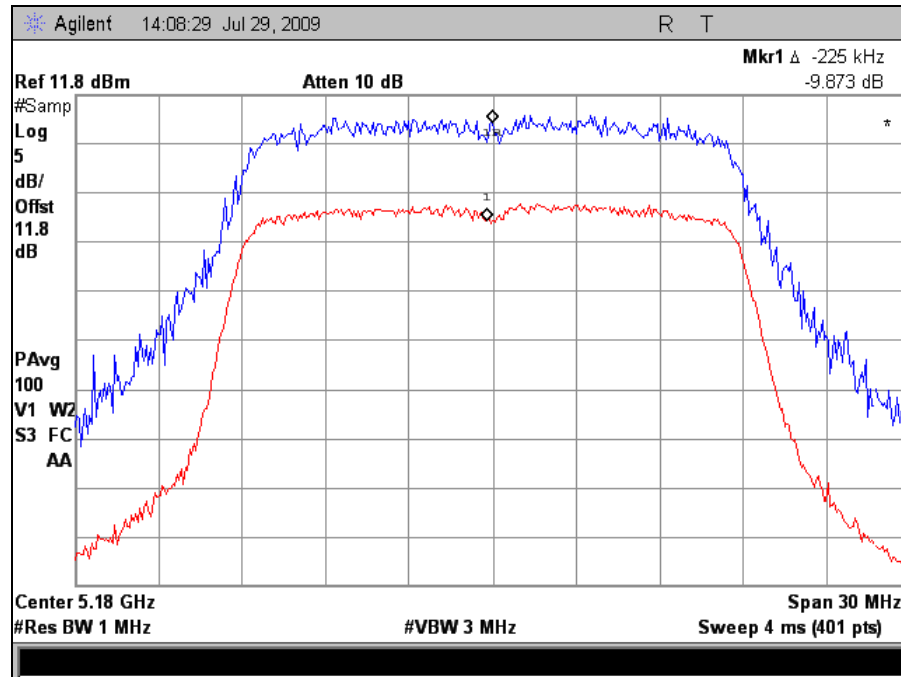


Plot 62. Peak Excursion, Port 2, 802.11n 40MHz, 5190 MHz

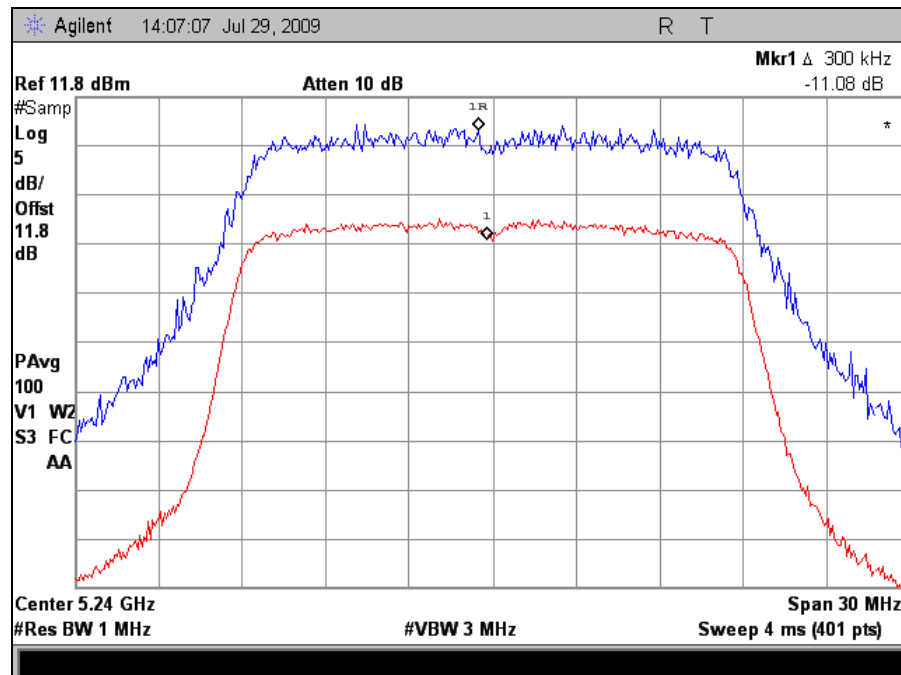


Plot 63. Peak Excursion, Port 2, 802.11n 40MHz, 5230 MHz

## Peak Excursion Ratio, Port 3, 802.11n 20MHz

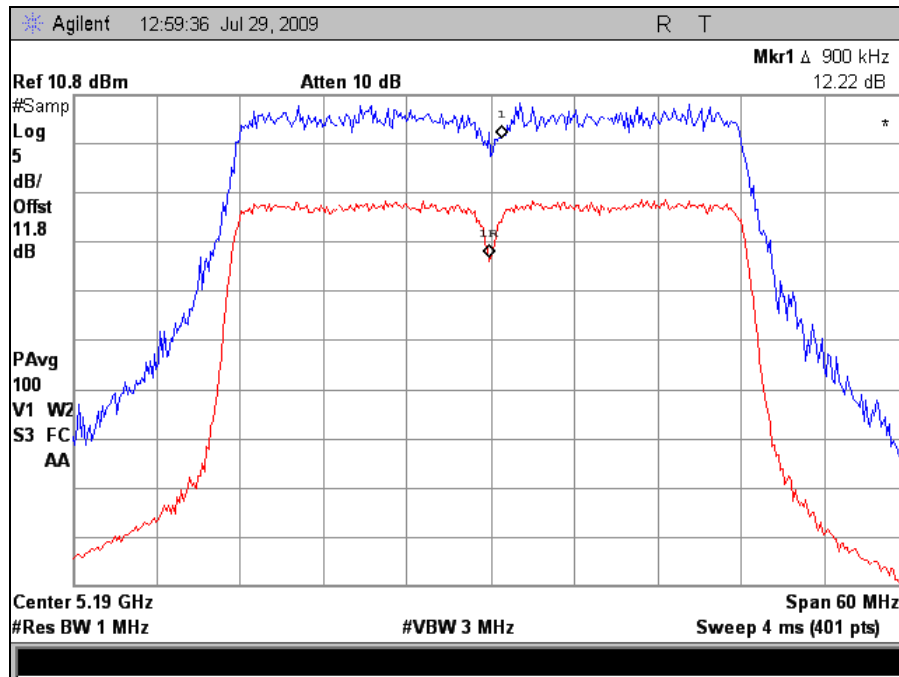


Plot 64. Peak Excursion, Port 3, 802.11n 20MHz, 5180 MHz

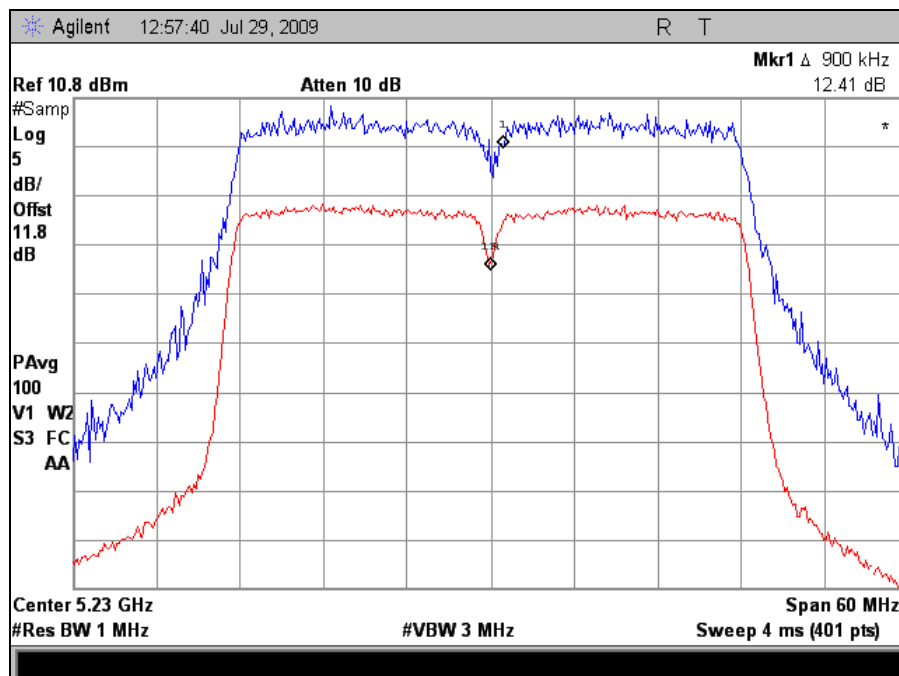


Plot 65. Peak Excursion, Port 3, 802.11n 20MHz, 5240 MHz

## Peak Excursion Ratio, Port 3, 802.11n 40MHz



Plot 66. Peak Excursion, Port 3, 802.11n 40MHz, 5190 MHz



Plot 67. Peak Excursion, Port 3, 802.11n 40MHz, 5230 MHz

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.407<sup>(b)(1), (6)</sup> Undesirable Emissions

**Test Requirements:** § 15.407<sup>(b)(1), (6)</sup>; §15.205: Emissions outside the frequency band.

**§ 15.407<sup>(b)(1)</sup>:** In any 1MHz bandwidth outside the frequency band 5.15-5.25GHz in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power shall not exceed -27dBm.

**§ 15.407<sup>(b)(6)</sup>:** Radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).

**§15.205(a):** Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz                           | MHz                 | MHz             | GHz              |
|-------------------------------|---------------------|-----------------|------------------|
| 0.090–0.110-----              | 16.42–16.423        | 399.9–410       | 4.5–5.15         |
| <sup>1</sup> 0.495–0.505----- | 16.69475–16.69525   | 608–614         | 5.35–5.46        |
| 2.1735–2.1905-----            | 16.80425–16.80475   | 960–1240        | 7.25–7.75        |
| 4.125–4.128-----              | 25.5–25.67          | 1300–1427       | 8.025–8.5        |
| 4.17725–4.17775-----          | 37.5–38.25          | 1435–1626.5     | 9.0–9.2          |
| 4.20725–4.20775-----          | 73–74.6             | 1645.5–1646.5   | 9.3–9.5          |
| 6.215–6.218-----              | 74.8–75.2           | 1660–1710       | 10.6–12.7        |
| 6.26775–6.26825-----          | 108–121.94          | 1718.8–1722.2   | 13.25–13.4       |
| 6.31175–6.31225-----          | 123–138             | 2200–2300       | 14.47–14.5       |
| 8.291–8.294-----              | 149.9–150.05        | 2310–2390       | 15.35–16.2       |
| 8.362–8.366-----              | 156.52475–156.52525 | 2483.5–2500     | 17.7–21.4        |
| 8.37625–8.38675-----          | 156.7–156.9         | 2655–2900       | 22.01–23.12      |
| 8.41425–8.41475-----          | 162.0125–167.17     | 3260–3267       | 23.6–24.0        |
| 12.29–12.293-----             | 167.72–173.2        | 3332–3339       | 31.2–31.8        |
| 12.51975–12.52025-----        | 240–285             | 3345.8–3358 36. | 43–36.5          |
| 12.57675–12.57725-----        | 322–335.4           | 3600–4400       | ( <sup>2</sup> ) |

**Table 31. Restricted Bands of Operation**

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test Procedure:</b>   | <p>The EUT was installed placed on a 0.8m-high wooden table inside a semi-anechoic chamber. The harmonic frequencies the carriers were recorded for reference for final measurements. A receiving horn antenna was placed 3m away from the EUT. Unless otherwise specified, measurements were made using 1MHz RBW &amp; 1MHz VBW for peak measurements and 1MHz RBW &amp; 10Hz VBW for average measurements on a spectrum analyzer.</p> <p>For each harmonic of the carrier frequency, the turntable was rotated, the positions of the interface cables were varied, and the antenna height was varied between 1 m and 4 m, in order to find the maximum radiated emissions.</p> <p>The equipment isotropic radiated power (EIRP) at -27dBm/MHz was converted to field strength at 68.23dBuV/m. At the band edge of each band, the EIRP energy measurement is integrated to show the total power over 1MHz.</p> |
| <b>Test Results:</b>     | <p>The EUT was found compliant with the requirement(s) of this section. Measured emissions were below applicable limits.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Test Engineer(s):</b> | Minh Ly                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Test Date(s):</b>     | 07/28/09 - 08/11/09                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |



## Electromagnetic Compatibility Criteria for Intentional Radiators

### Harmonic Emissions Requirements – Radiated (Port 1, 802.11a)

| Freq. (GHz) | Antenna Polarity (H/V) | Raw Amp. @ 3 m (Peak) / (Avg.) | P. Amp. (dB) | Ant. Cor. Factor (dB/m) | Cable Loss (dB) | EUT Field Strength Final Amp. (dBuV/m) | Limit Detector Peak / Avg. | Limit @ 3 m (dBuV/m) | Delta (dB) |
|-------------|------------------------|--------------------------------|--------------|-------------------------|-----------------|----------------------------------------|----------------------------|----------------------|------------|
| 10.36       | V                      | 46.45                          | 35.34        | 38.18                   | 6.92            | 56.22                                  | Peak                       | 74                   | -17.78     |
| 10.36       | V                      | 31.42                          | 35.34        | 38.18                   | 6.92            | 41.19                                  | Avg.                       | 54                   | -12.81     |
| 15.54       | V                      | 46.06                          | 34.83        | 38.08                   | 8.89            | 58.20                                  | Peak                       | 74                   | -15.80     |
| 15.54       | V                      | 31.96                          | 34.83        | 38.08                   | 8.89            | 44.10                                  | Avg.                       | 54                   | -9.90      |

**Table 32. Radiated Harmonics, Port 1, 802.11a, 5 dBi Omni, 5180 MHz**

Note: All other emissions were measured at the noise floor of the spectrum analyzer.

| Freq. (GHz) | Antenna Polarity (H/V) | Raw Amp. @ 3 m (Peak) / (Avg.) | P. Amp. (dB) | Ant. Cor. Factor (dB/m) | Cable Loss (dB) | EUT Field Strength Final Amp. (dBuV/m) | Limit Detector Peak / Avg. | Limit @ 3 m (dBuV/m) | Delta (dB) |
|-------------|------------------------|--------------------------------|--------------|-------------------------|-----------------|----------------------------------------|----------------------------|----------------------|------------|
| 10.48       | V                      | 44.55                          | 35.23        | 38.19                   | 6.85            | 54.36                                  | Peak                       | 74                   | -19.64     |
| 10.48       | V                      | 31.1                           | 35.23        | 38.19                   | 6.85            | 40.91                                  | Avg.                       | 54                   | -13.09     |
| 15.72       | V                      | 44.02                          | 34.92        | 37.73                   | 8.88            | 55.71                                  | Peak                       | 74                   | -18.29     |
| 15.72       | V                      | 32.04                          | 34.92        | 37.73                   | 8.88            | 43.73                                  | Avg.                       | 54                   | -10.27     |

**Table 33. Radiated Harmonics, Port 1, 802.11a, 5 dBi Omni, 5240 MHz**

Note: All other emissions were measured at the noise floor of the spectrum analyzer.

### Harmonic Emissions Requirements – Radiated (802.11n 20MHz)

| Freq. (GHz) | Antenna Polarity (H/V) | Raw Amp. @ 3 m (Peak) / (Avg.) | P. Amp. (dB) | Ant. Cor. Factor (dB/m) | Cable Loss (dB) | EUT Field Strength Final Amp. (dBuV/m) | Limit Detector Peak / Avg. | Limit @ 3 m (dBuV/m) | Delta (dB) |
|-------------|------------------------|--------------------------------|--------------|-------------------------|-----------------|----------------------------------------|----------------------------|----------------------|------------|
| 10.36       | V                      | 45.6                           | 35.34        | 38.18                   | 6.92            | 55.37                                  | Peak                       | 74                   | -18.63     |
| 10.36       | V                      | 32.12                          | 35.34        | 38.18                   | 6.92            | 41.89                                  | Avg.                       | 54                   | -12.11     |
| 15.54       | V                      | 45.5                           | 34.83        | 38.08                   | 8.89            | 57.64                                  | Peak                       | 74                   | -16.36     |
| 15.54       | V                      | 31.7                           | 34.83        | 38.08                   | 8.89            | 43.84                                  | Avg.                       | 54                   | -10.16     |

**Table 34. Radiated Harmonics, 802.11n 20MHz, 5 dBi Omni, 5180 MHz**

Note: All other emissions were measured at the noise floor of the spectrum analyzer.

| Freq. (GHz) | Antenna Polarity (H/V) | Raw Amp. @ 3 m (Peak) / (Avg.) | P. Amp. (dB) | Ant. Cor. Factor (dB/m) | Cable Loss (dB) | EUT Field Strength Final Amp. (dBuV/m) | Limit Detector Peak / Avg. | Limit @ 3 m (dBuV/m) | Delta (dB) |
|-------------|------------------------|--------------------------------|--------------|-------------------------|-----------------|----------------------------------------|----------------------------|----------------------|------------|
| 10.48       | V                      | 45.47                          | 35.23        | 38.19                   | 6.85            | 55.28                                  | Peak                       | 74                   | -18.72     |
| 10.48       | V                      | 31.46                          | 35.23        | 38.19                   | 6.85            | 41.27                                  | Avg.                       | 54                   | -12.73     |
| 15.72       | V                      | 45.12                          | 34.92        | 37.73                   | 8.88            | 56.81                                  | Peak                       | 74                   | -17.19     |
| 15.72       | V                      | 31.87                          | 34.92        | 37.73                   | 8.88            | 43.56                                  | Avg.                       | 54                   | -10.44     |

**Table 35. Radiated Harmonics, 802.11n 20MHz, 5 dBi Omni, 5240 MHz**

Note: All other emissions were measured at the noise floor of the spectrum analyzer.

## Harmonic Emissions Requirements – Radiated (802.11n 40MHz)

| Freq. (GHz) | Antenna Polarity (H/V) | Raw Amp. @ 3 m (Peak) / (Avg.) | P. Amp. (dB) | Ant. Cor. Factor (dB/m) | Cable Loss (dB) | EUT Field Strength Final Amp. (dBuV/m) | Limit Detector Peak / Avg. | Limit @ 3 m (dBuV/m) | Delta (dB) |
|-------------|------------------------|--------------------------------|--------------|-------------------------|-----------------|----------------------------------------|----------------------------|----------------------|------------|
| 10.38       | V                      | 45.49                          | 35.32        | 38.18                   | 6.91            | 55.25                                  | Peak                       | 74                   | -18.75     |
| 10.38       | V                      | 32.48                          | 35.32        | 38.18                   | 6.91            | 42.24                                  | Avg.                       | 54                   | -11.76     |
| 15.57       | V                      | 44.48                          | 34.84        | 38.00                   | 8.89            | 56.53                                  | Peak                       | 74                   | -17.47     |
| 15.57       | V                      | 31.52                          | 34.84        | 38.00                   | 8.89            | 43.57                                  | Avg.                       | 54                   | -10.43     |

**Table 36. Radiated Harmonics, 802.11n 40MHz, 5 dBi Omni, 5190 MHz**

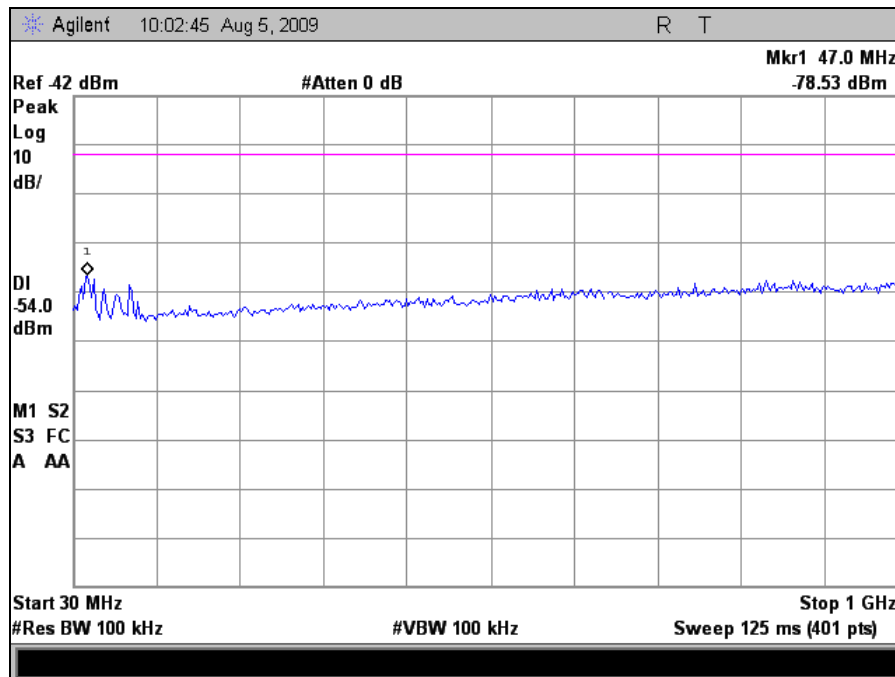
Note: All other emissions were measured at the noise floor of the spectrum analyzer.

| Freq. (GHz) | Antenna Polarity (H/V) | Raw Amp. @ 3 m (Peak) / (Avg.) | P. Amp. (dB) | Ant. Cor. Factor (dB/m) | Cable Loss (dB) | EUT Field Strength Final Amp. (dBuV/m) | Limit Detector Peak / Avg. | Limit @ 3 m (dBuV/m) | Delta (dB) |
|-------------|------------------------|--------------------------------|--------------|-------------------------|-----------------|----------------------------------------|----------------------------|----------------------|------------|
| 10.46       | V                      | 44.03                          | 35.25        | 38.18                   | 6.85            | 53.82                                  | Peak                       | 74                   | -20.18     |
| 10.46       | V                      | 31.93                          | 35.25        | 38.18                   | 6.85            | 41.72                                  | Avg.                       | 54                   | -12.28     |
| 15.69       | V                      | 44.84                          | 34.90        | 37.77                   | 8.88            | 56.59                                  | Peak                       | 74                   | -17.41     |
| 15.69       | V                      | 31.79                          | 34.90        | 37.77                   | 8.88            | 43.54                                  | Avg.                       | 54                   | -10.46     |

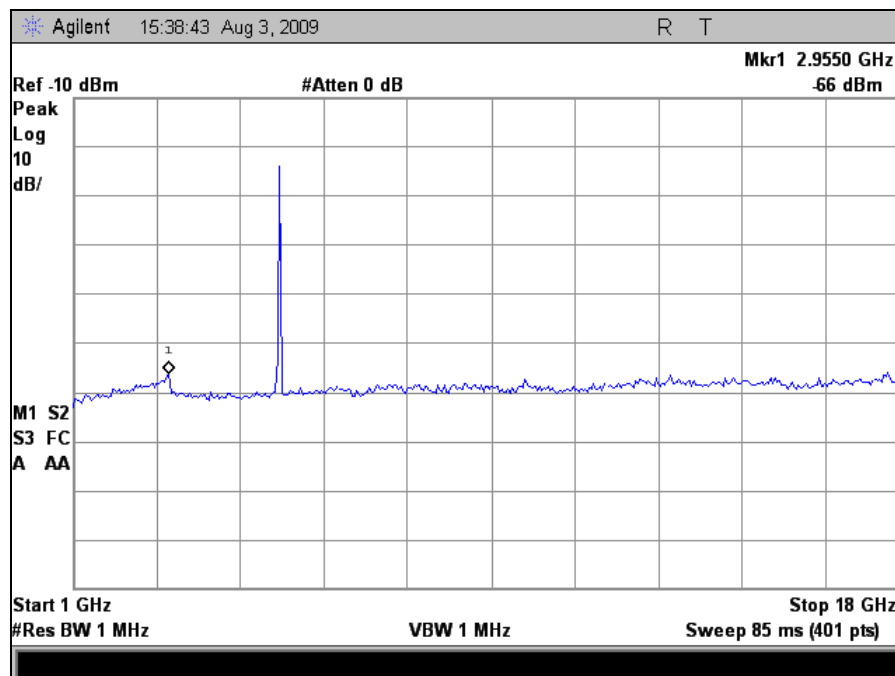
**Table 37. Radiated Harmonics, 802.11n 40MHz, 5 dBi Omni, 5230 MHz**

Note: All other emissions were measured at the noise floor of the spectrum analyzer.

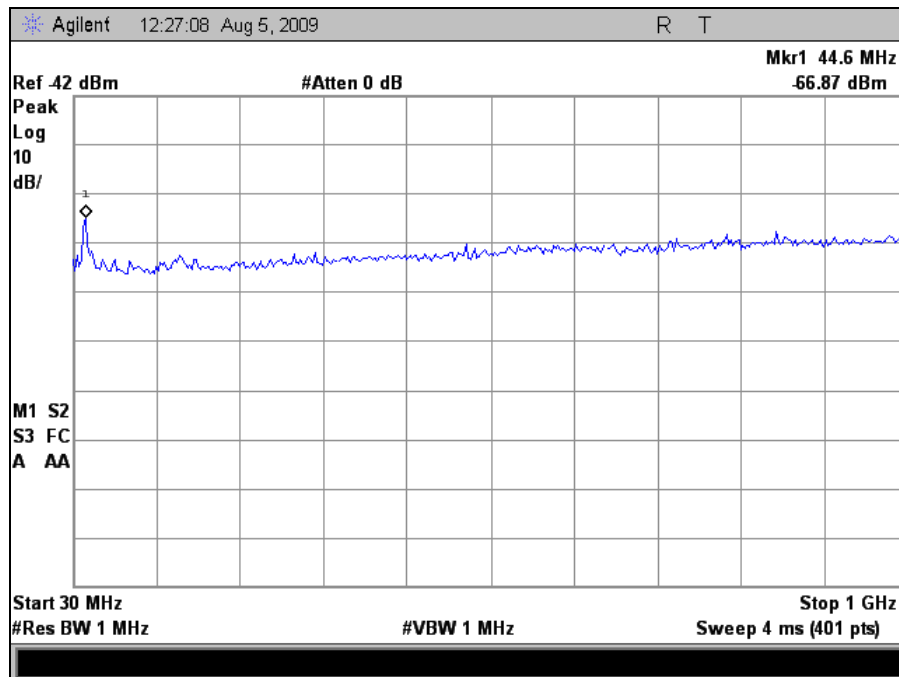
## § 15.209 Radiated Emissions Limits, Port 1, 802.11a



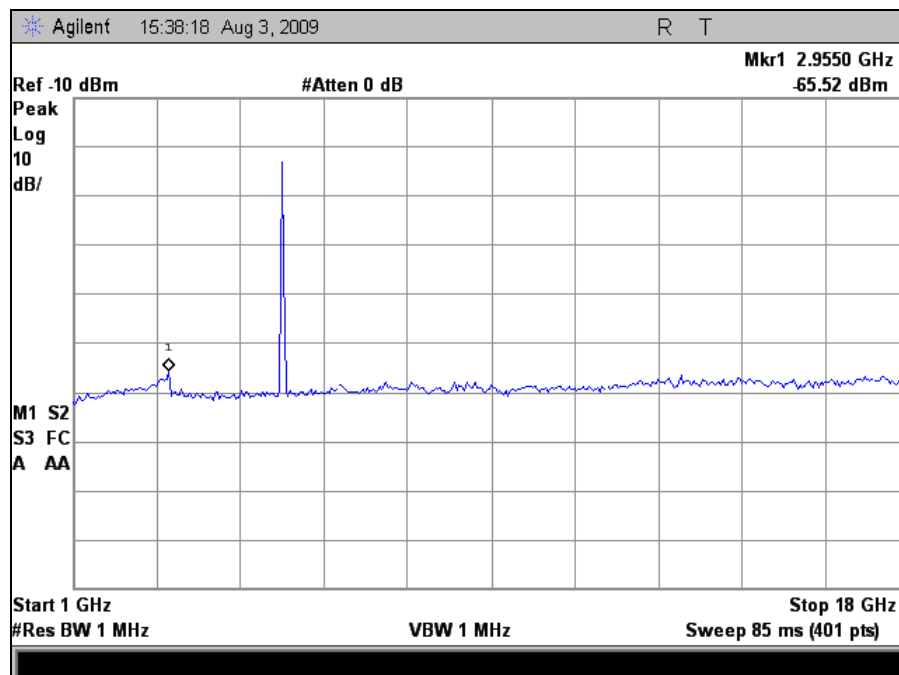
Plot 68. Radiated Spurious, Port 1, 802.11a, 5180 MHz, 30 MHz – 1 GHz



Plot 69. Radiated Spurious, Port 1, 802.11a, 5180 MHz, 1 GHz – 18 GHz

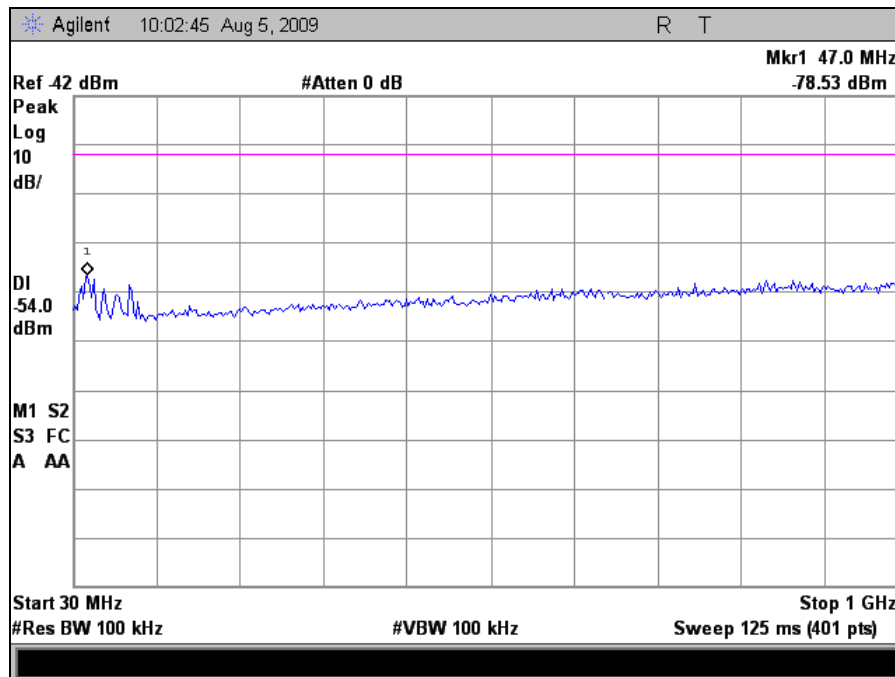


Plot 70. Radiated Spurious, Port 1, 802.11a, 5240 MHz, 30 MHz – 1 GHz

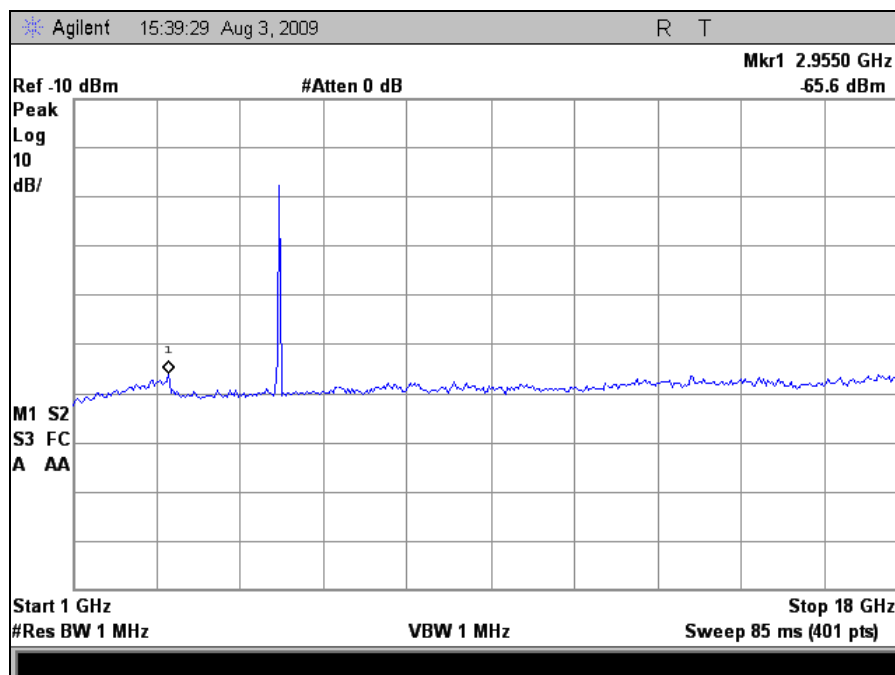


Plot 71. Radiated Spurious, Port 1, 802.11a, 5240 MHz, 1 GHz – 18 GHz

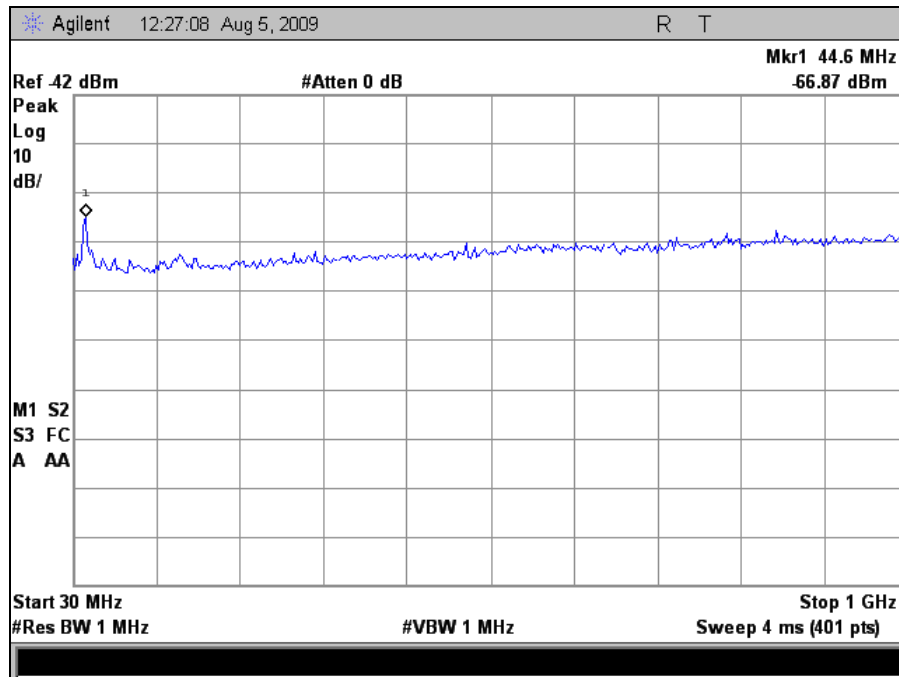
## § 15.209 Radiated Emissions Limits, 802.11n 20MHz



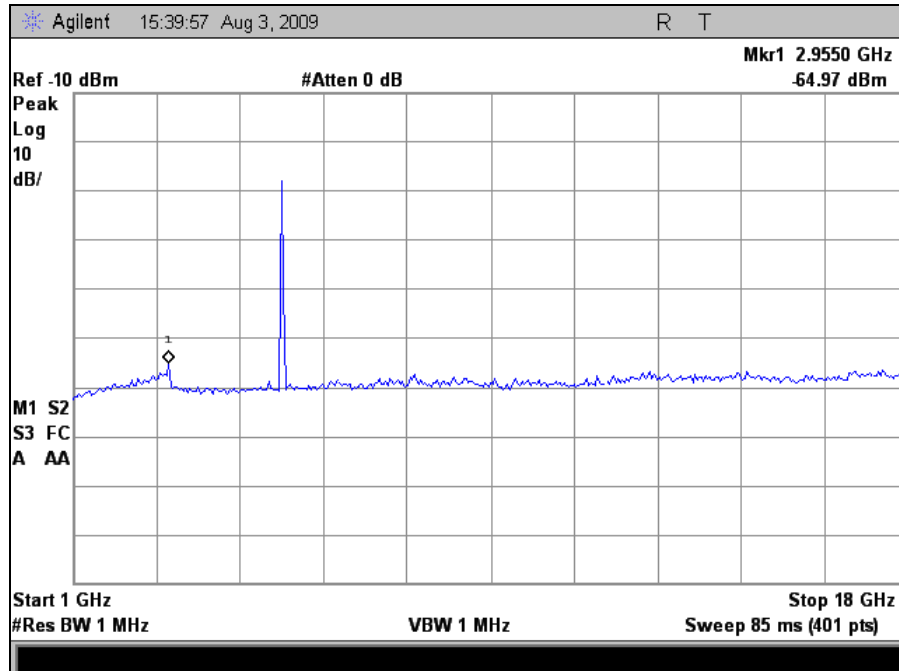
Plot 72. Radiated Spurious, 802.11n 20MHz, 5180 MHz, 30 MHz – 1 GHz



Plot 73. Radiated Spurious, 802.11n 20MHz, 5180 MHz, 1 GHz – 18 GHz

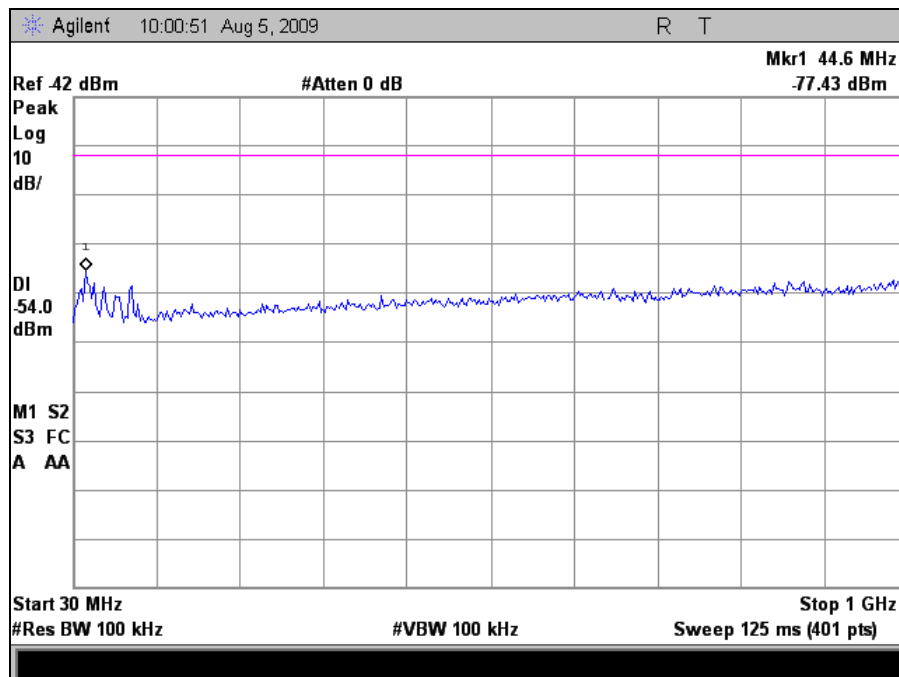


Plot 74. Radiated Spurious, 802.11n 20MHz, 5240 MHz, 30 MHz – 1 GHz

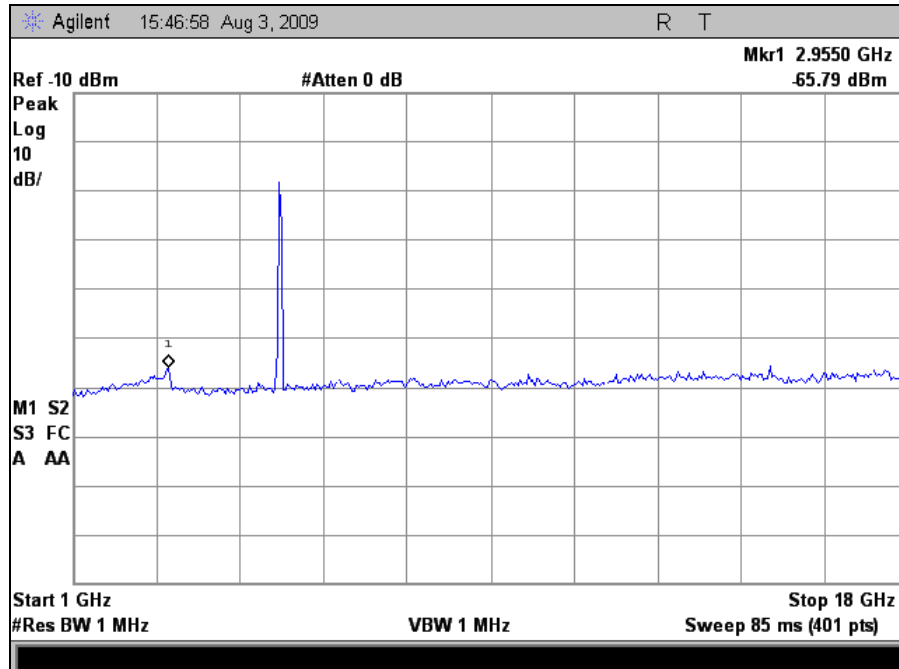


Plot 75. Radiated Spurious, 802.11n 20MHz, 5240 MHz, 1 GHz – 18 GHz

## § 15.209 Radiated Emissions Limits, 802.11n 40MHz

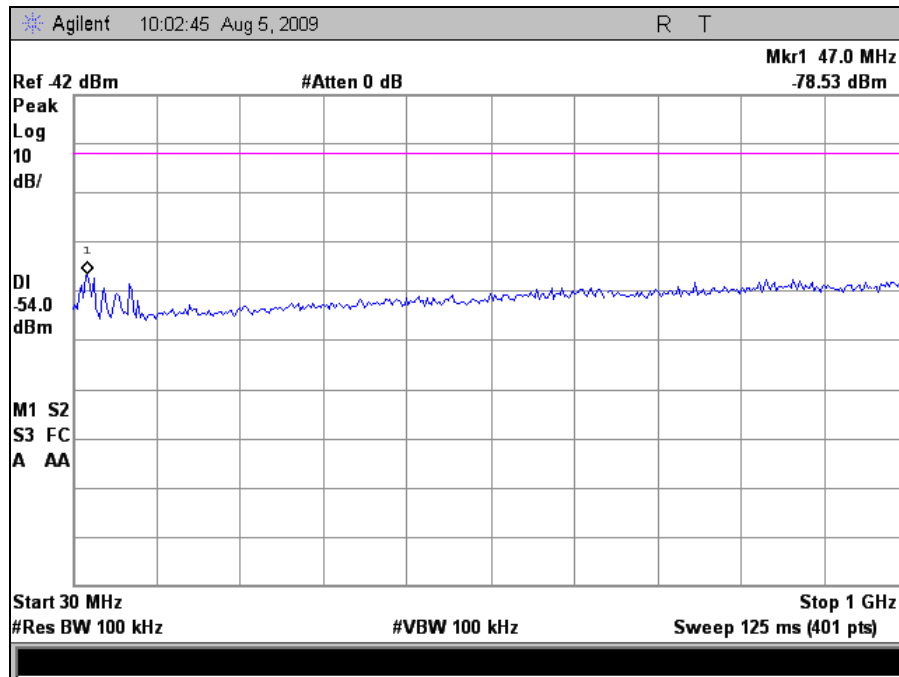


Plot 76. Radiated Spurious, 802.11n 40MHz, 5190 MHz, 30 MHz – 1 GHz

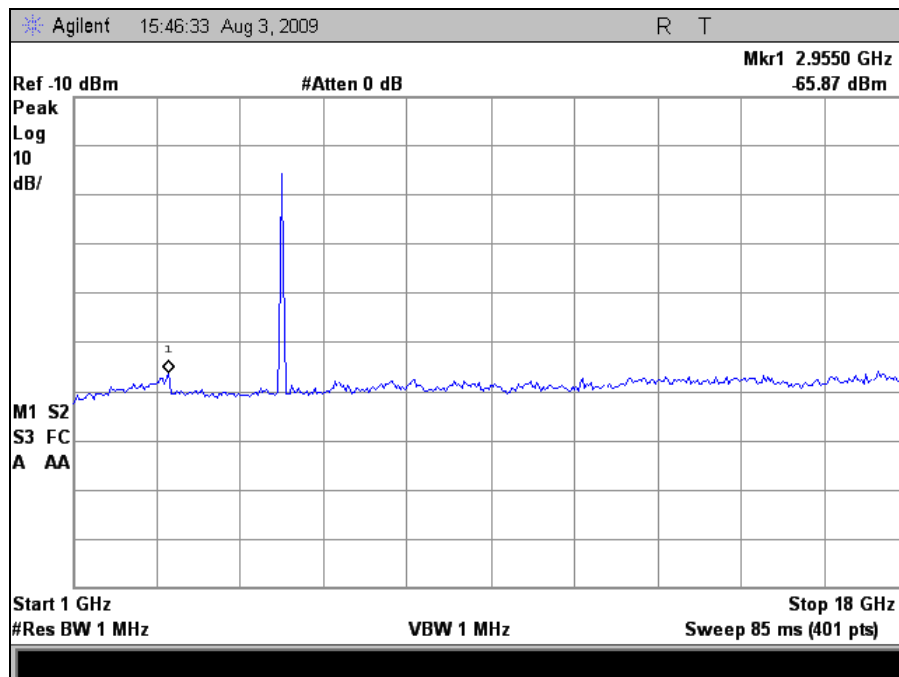


Plot 77. Radiated Spurious, 802.11n 40MHz, 5190 MHz, 1 GHz – 18 GHz





Plot 78. Radiated Spurious, 802.11n 40MHz, 5230 MHz, 30 MHz – 1 GHz



Plot 79. Radiated Spurious, 802.11n 40MHz, 5230 MHz, 1 GHz – 18 GHz

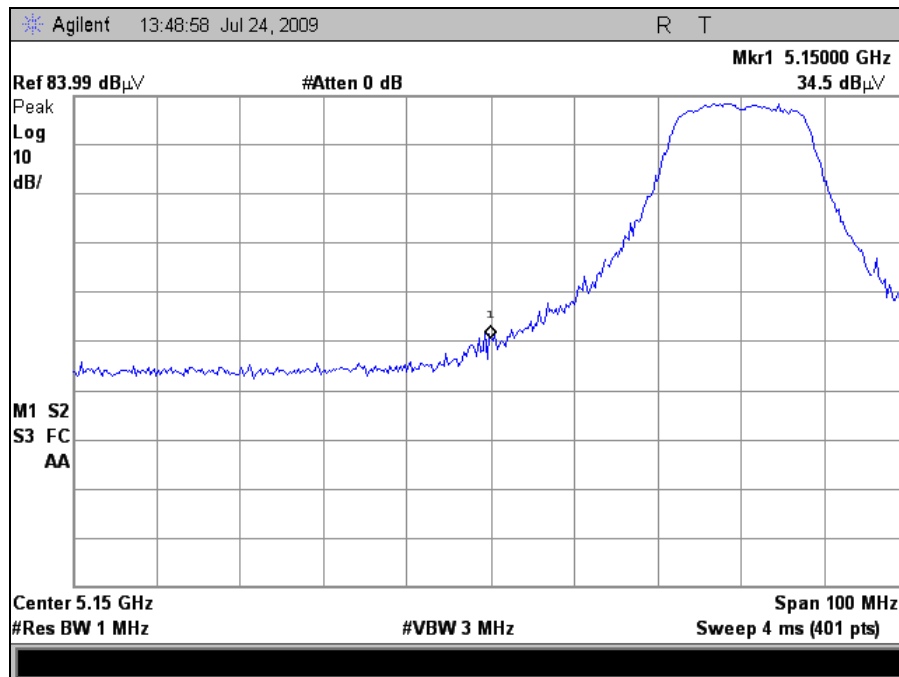
## EIRP

| 5dBi Omni Antenna |                |                         |            |     |      |           |                |        |
|-------------------|----------------|-------------------------|------------|-----|------|-----------|----------------|--------|
| 802.11a           | Band Edge Freq | Uncorrected Peak (dBuV) | Cable Loss | ACF | DCF  | Corrected | Limit (dBuV/m) | Margin |
|                   | 5150 MHz       | 19.28                   | 6.9        | 35  | 9.54 | 51.64     | 68.23          | -16.59 |
| 802.11n 20MHz     | Band Edge Freq | Uncorrected Peak (dBuV) | Cable Loss | ACF | DCF  | Corrected | Limit (dBuV/m) | Margin |
|                   | 5150 MHz       | 34.53                   | 6.9        | 35  | 9.54 | 66.89     | 68.23          | -1.34  |
| 802.11n 40MHz     | Band Edge Freq | Uncorrected Peak (dBuV) | Cable Loss | ACF | DCF  | Corrected | Limit (dBuV/m) | Margin |
|                   | 5150 MHz       | 34.04                   | 6.9        | 35  | 9.54 | 66.4      | 68.23          | -1.83  |

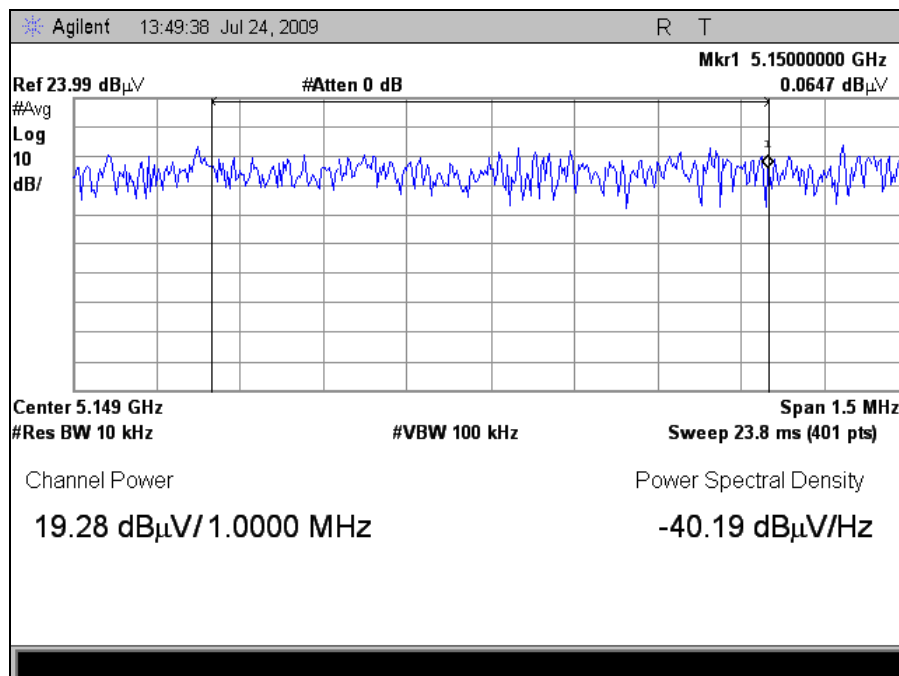
**Table 38. EIRP Calculation**

Note: EIRP Limit -27dBm/MHz = 68.23dBuV/m

## EIRP, Port 1, 802.11a

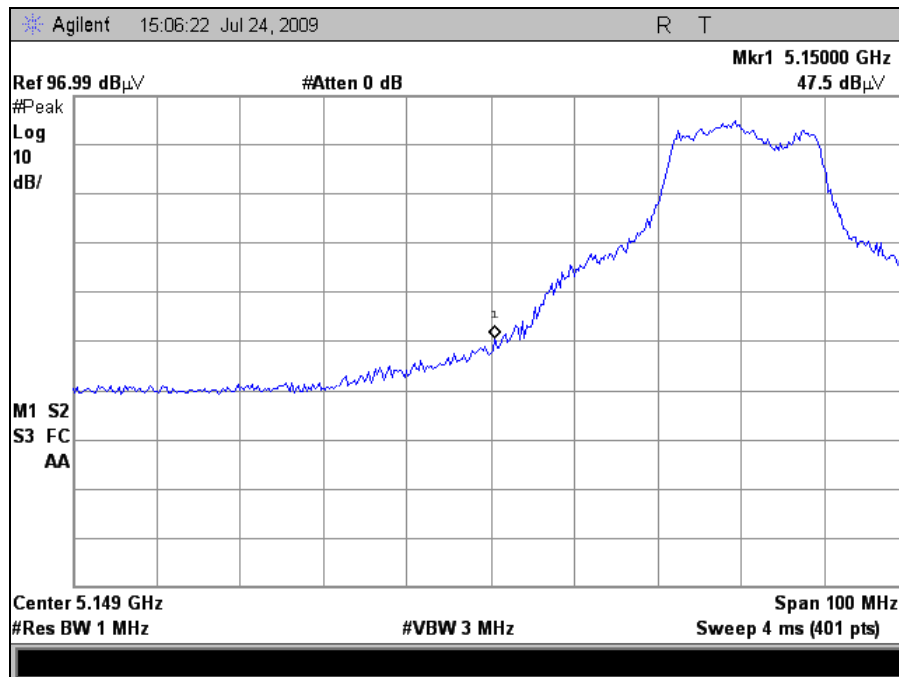


Plot 80. EIRP, Port 1, 802.11a, 5150 MHz Peak

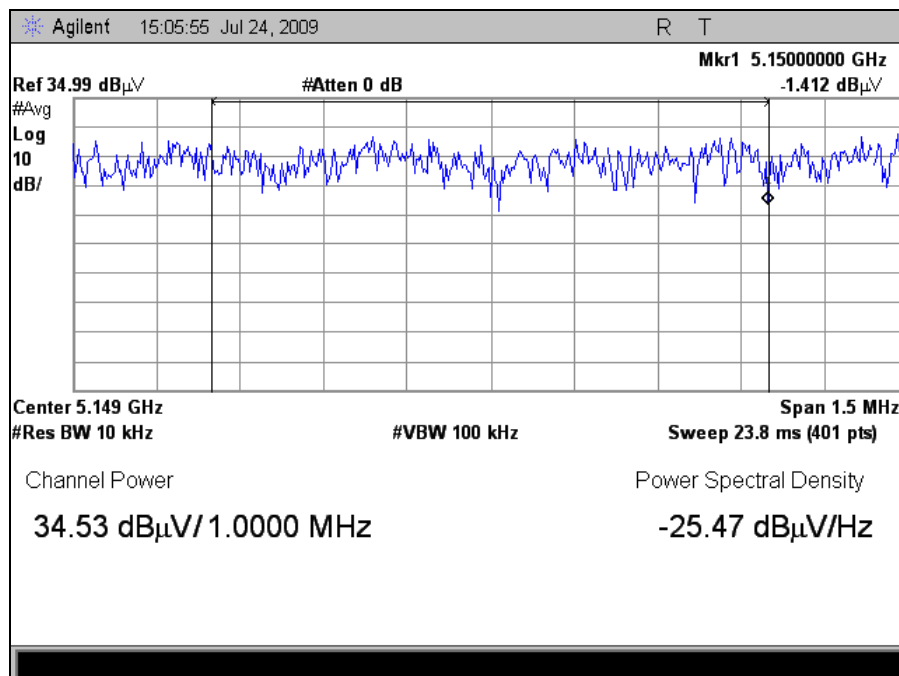


Plot 81. EIRP, Port 1, 802.11a, 5150 MHz Over 1 MHz

## EIRP, 802.11n 20MHz

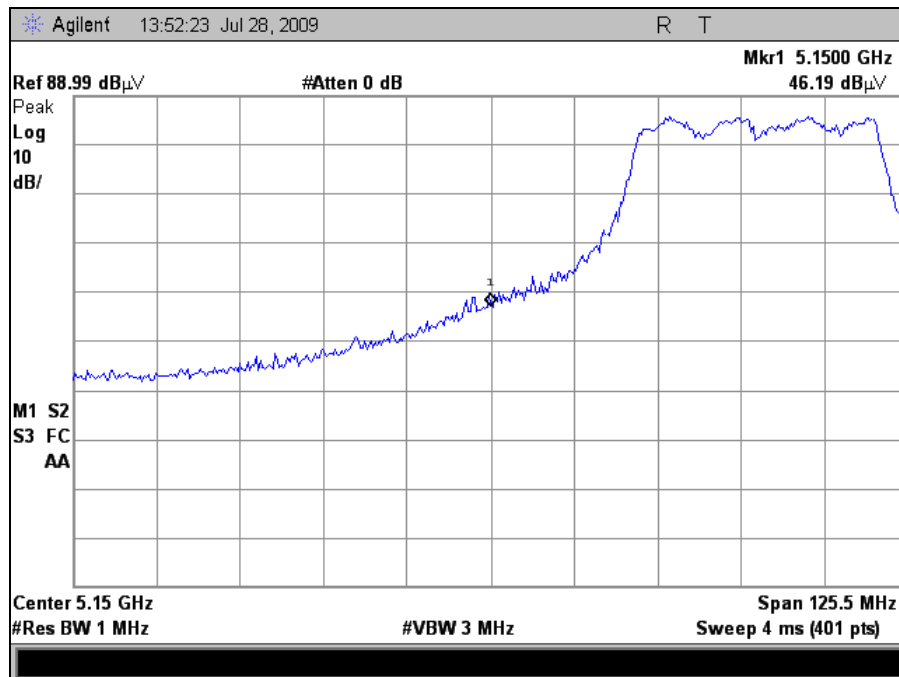


Plot 82. EIRP, 802.11n 20MHz, 5150 MHz Peak

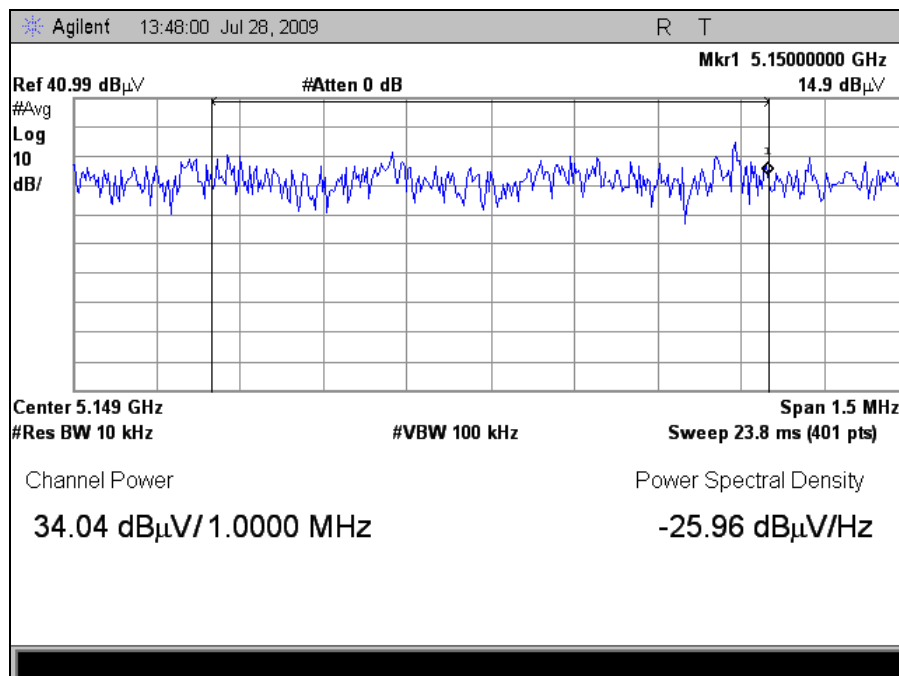


Plot 83. EIRP, 802.11n 20MHz, 5150 MHz Over 1 MHz

## EIRP, 802.11n 40MHz



Plot 84. EIRP, 802.11n 40MHz, 5150 MHz Peak



Plot 85. EIRP, 802.11n 40MHz, 5150 MHz Over 1 MHz

## Radiated Measurements Test Setup Photograph



**Photograph 6. Test Equipment and Setup for Various Radiated Measurements**

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.407(f) RF Exposure

**RF Exposure Requirements:** §1.1307(b)(1) and §1.1307(b)(2): Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

**RF Radiation Exposure Limit:** §1.1310: As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

MPE Limit Calculation: EUT's operating frequencies @ 5150-5250 MHz, highest conducted power = 15.55dBm (peak) (802.11a); therefore, **Limit for Uncontrolled exposure: 1 mW/cm<sup>2</sup> or 10 W/m<sup>2</sup>**

EUT maximum antenna gain = 5 dBi.

Equation from page 18 of OET 65, Edition 97-01

$$S = PG / 4\pi R^2 \quad \text{or} \quad R = \sqrt{PG / 4\pi S}$$

where, S = Power Density (1 mW/cm<sup>2</sup>)  
P = Power Input to antenna (35.89mW)  
G = Antenna Gain (3.16 numeric)

$$S = (35.89 * 3.162 / 4 * 3.14 * 20.0^2) = (113.5011 / 5024) = \mathbf{0.022 \text{ mW/cm}^2 @ 20\text{cm separation}}$$

MPE Limit Calculation: EUT's operating frequencies @ 5150-5250 MHz; highest conducted power = 16.57dBm (peak) (802.11n); therefore, **Limit for Uncontrolled exposure: 1 mW/cm<sup>2</sup> or 10 W/m<sup>2</sup>**

EUT maximum antenna gain = 5 dBi.

Equation from page 18 of OET 65, Edition 97-01

$$S = PG / 4\pi R^2 \quad \text{or} \quad R = \sqrt{PG / 4\pi S}$$

where, S = Power Density (1 mW/cm<sup>2</sup>)  
P = Power Input to antenna (45.39mW)  
G = Antenna Gain (3.16 numeric)

$$S = (45.39 * 3.16 / 4 * 3.14 * 20.0^2) = (143.54 / 5024) = \mathbf{0.028 \text{ mW/cm}^2 @ 20\text{cm separation}}$$

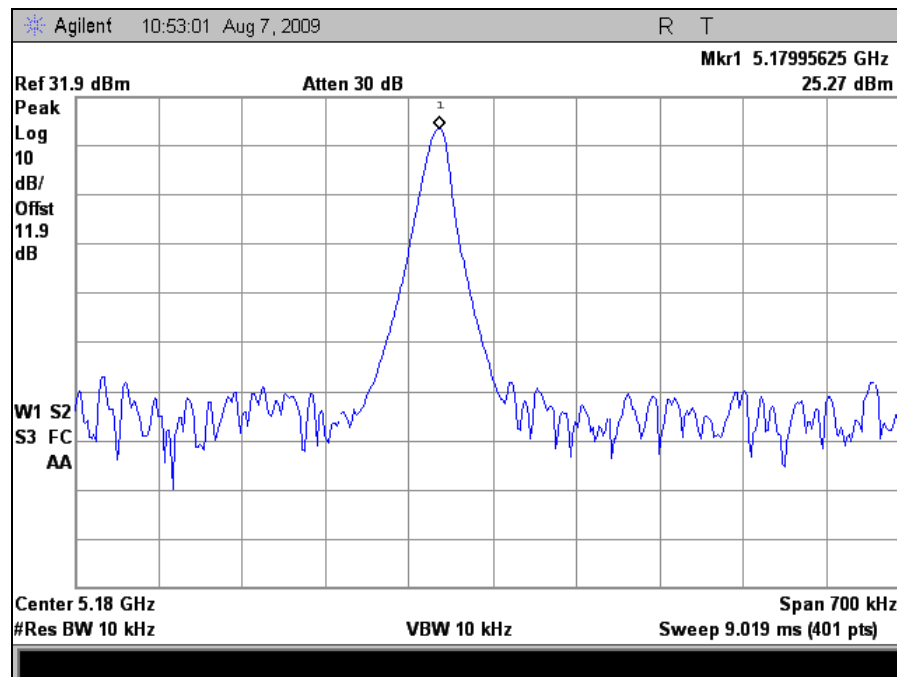
## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.407(g) Frequency Stability

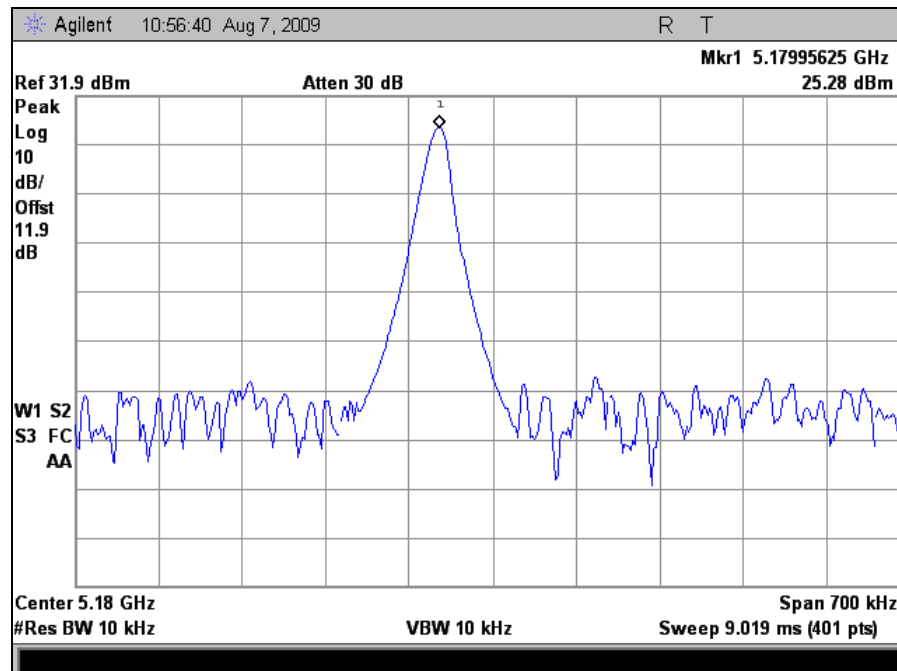
|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test Requirements:</b> | § 15.407(g): Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Test Procedure:</b>    | The EUT was placed in an environmental chamber and the RF port was connected directly to a spectrum analyzer through an attenuator. Depending on which band was being investigated, the EUT was set to transmit at the low, mid, and high with the appropriate power level. If the EUT was capable of transmitting a CW carrier then the spectrum analyzer's frequency counting function was used to measure the actual frequency. If only a modulated carrier was available then the frequency relative to -10dBc above and below the carrier was measured and the carrier frequency was determined using $(f1+f2)/2$ . The frequency of the carrier was measured at normal and extreme conditions. The resulting carrier frequencies were tabulated below with the temperature range of -40°C to +60°C . |
| <b>Test Results:</b>      | The EUT was found compliant with the requirements of §15.407(g)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Test Engineer(s):</b>  | 08/19/09 – 08/20/09                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Test Date(s):</b>      | Anderson Soungpanya                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |



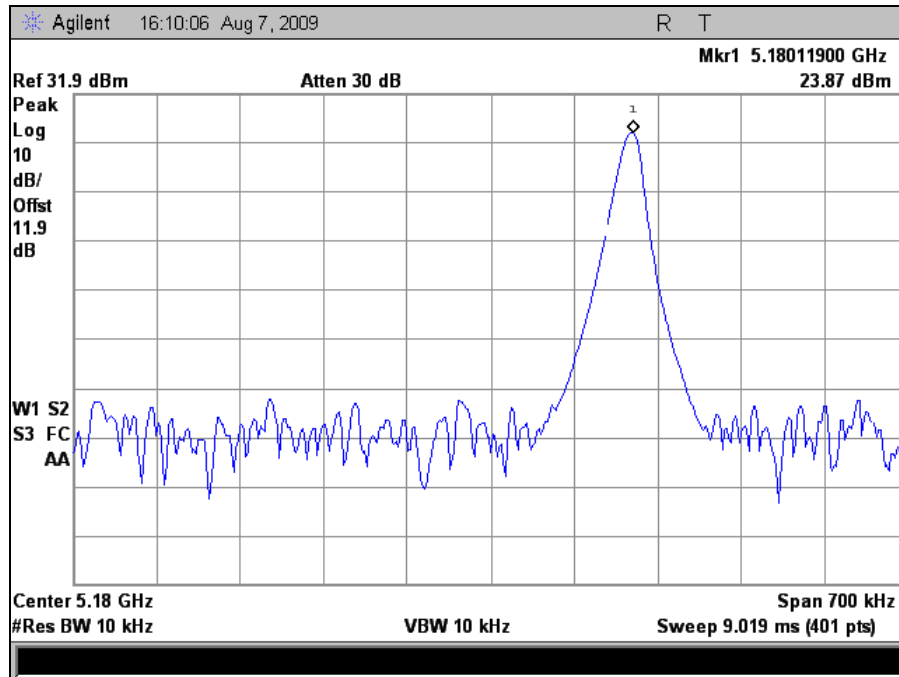
## Frequency Stability, Port 1



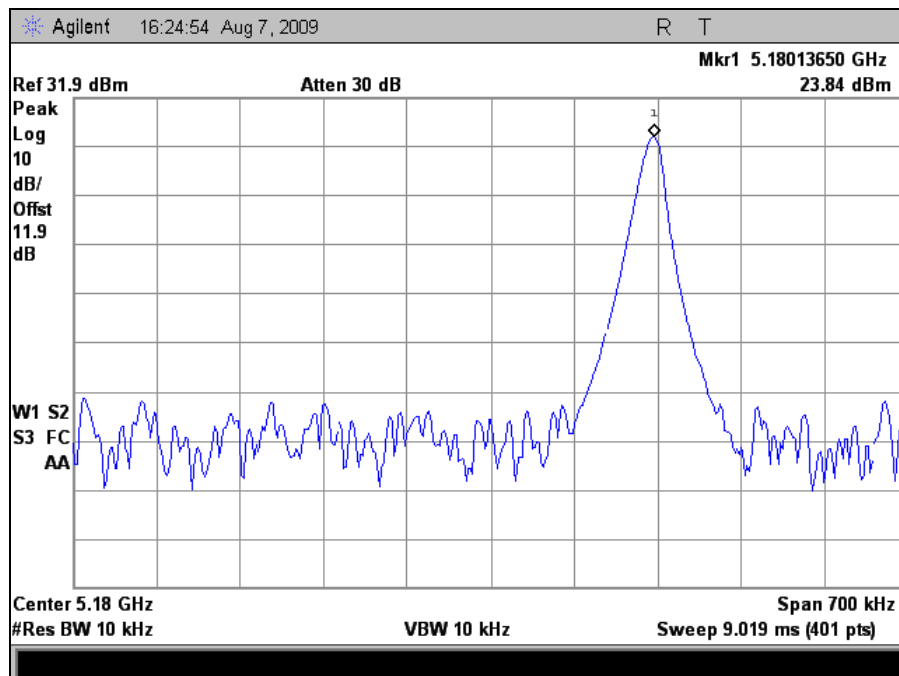
Plot 86. Freq. Stability, Port 1, 5180 MHz @-40C Low Volt.



Plot 87. Freq. Stability, Port 1, 5180 MHz @-40C High Volt.

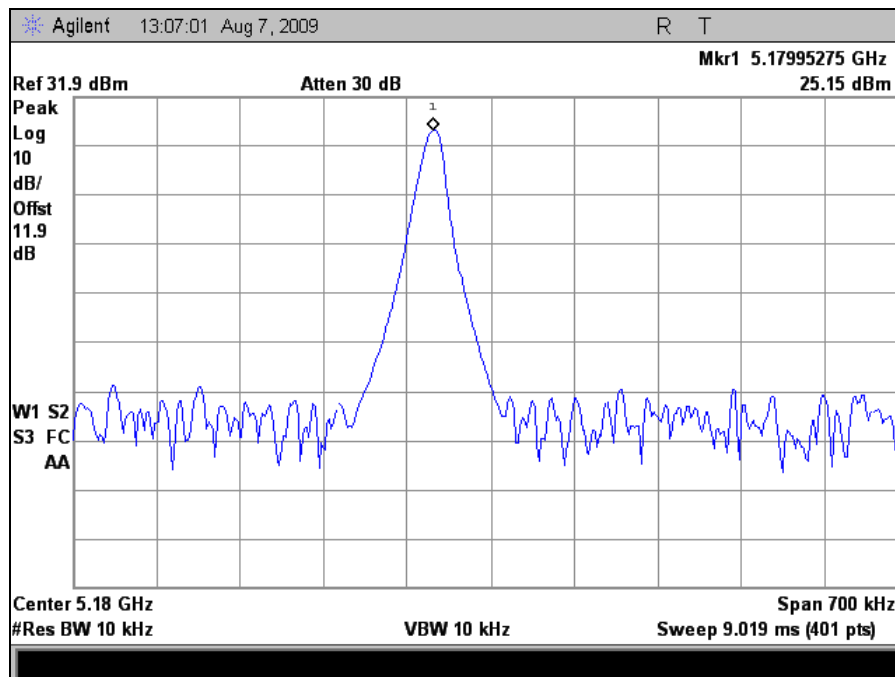


Plot 88. Freq. Stability, Port 1, 5180 MHz @+60C Low Volt.

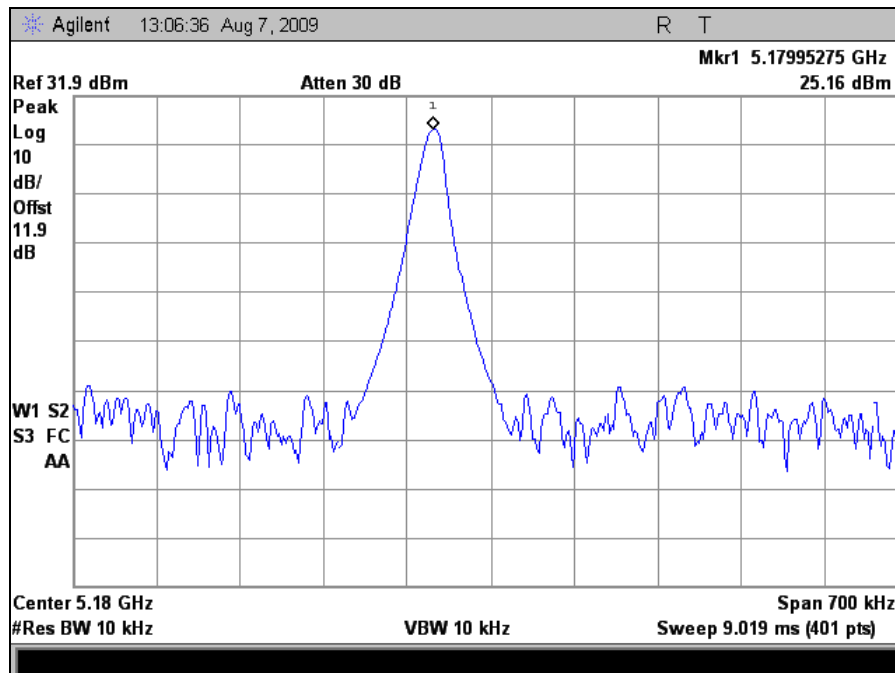


Plot 89. Freq. Stability, Port 1, 5180 MHz @+60C High Volt.

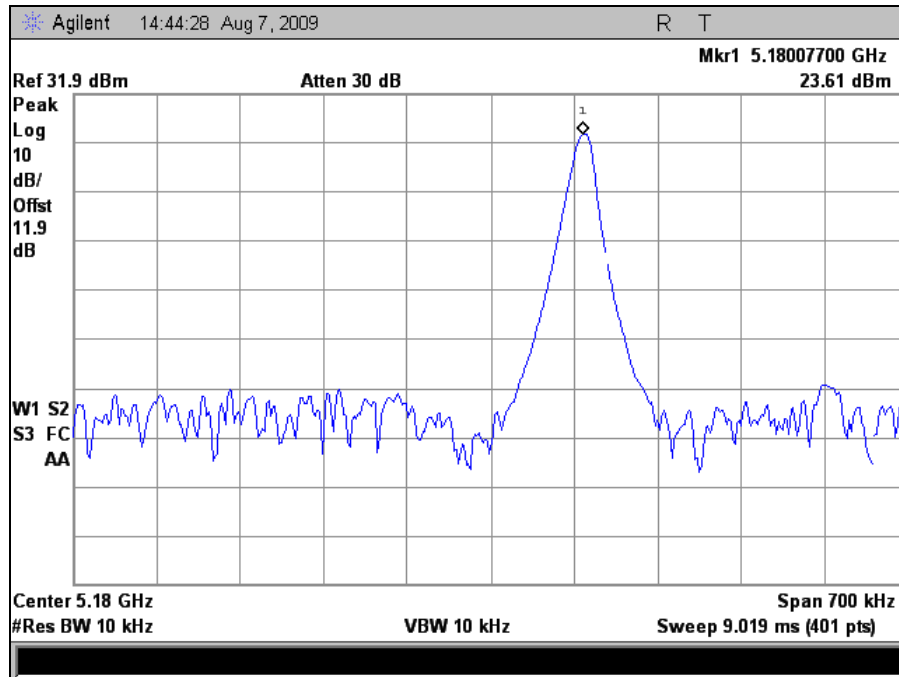
## Frequency Stability, Port 2



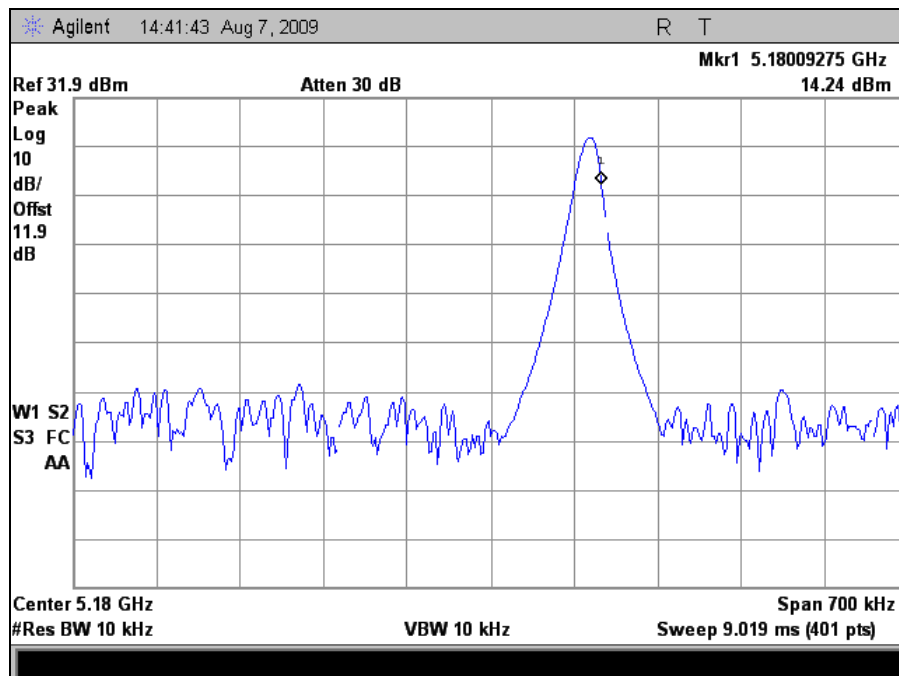
Plot 90. Freq. Stability, Port 2, 5180 MHz @-40C Low Volt.



Plot 91. Freq. Stability, Port 2, 5180 MHz @-40C High Volt.

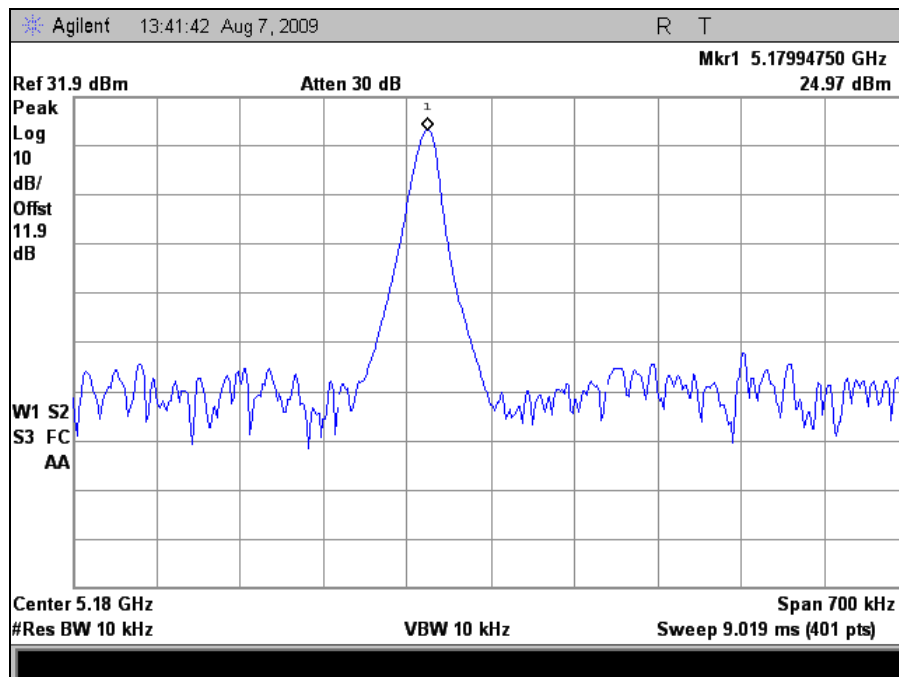


Plot 92. Freq. Stability, Port 2, 5180 MHz @+60C Low Volt.

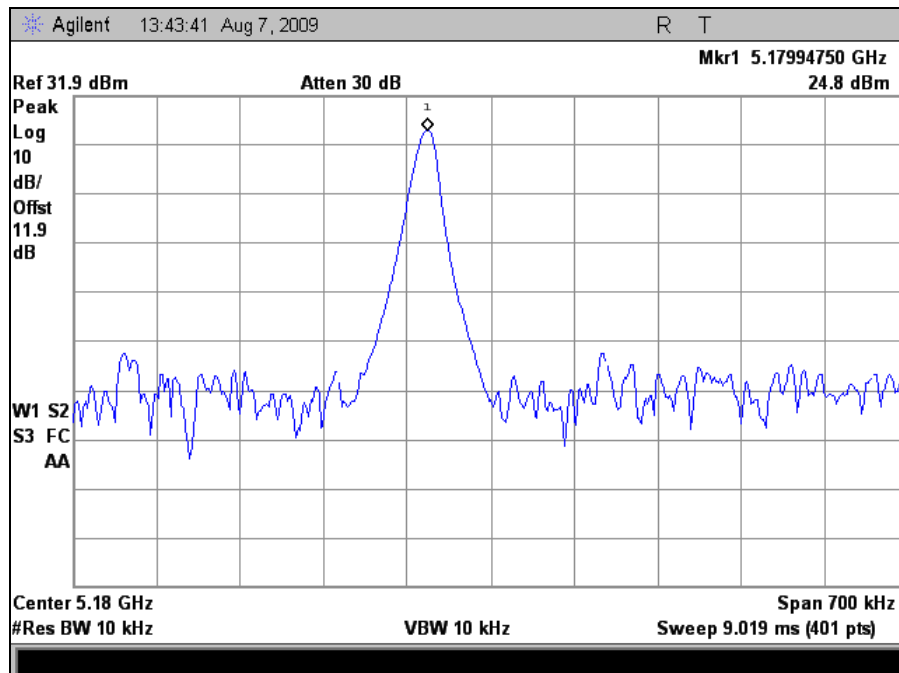


Plot 93. Freq. Stability, Port 2, 5180 MHz @+60C High Volt.

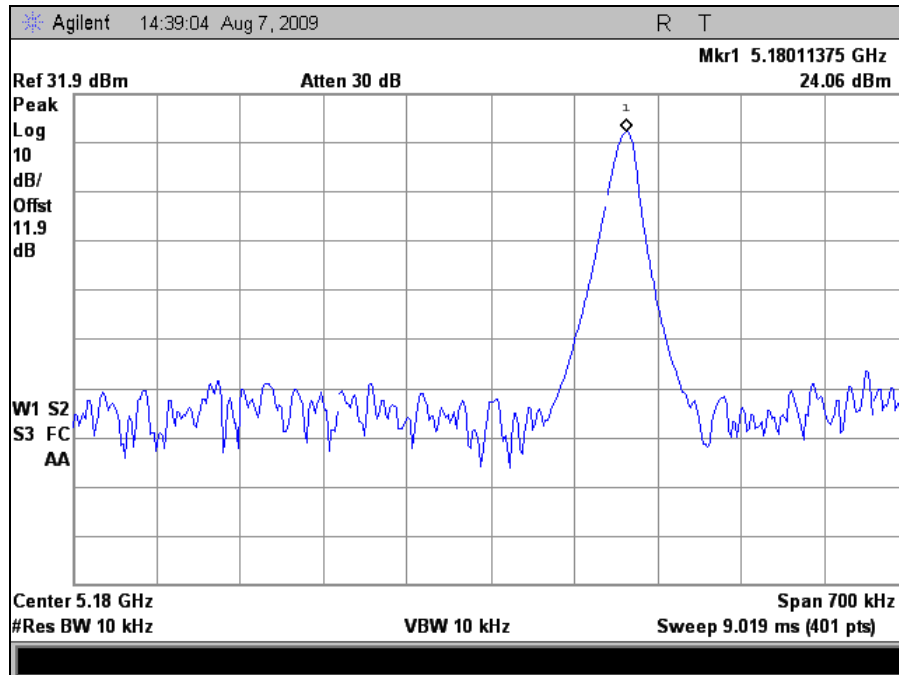
## Frequency Stability, Port 3



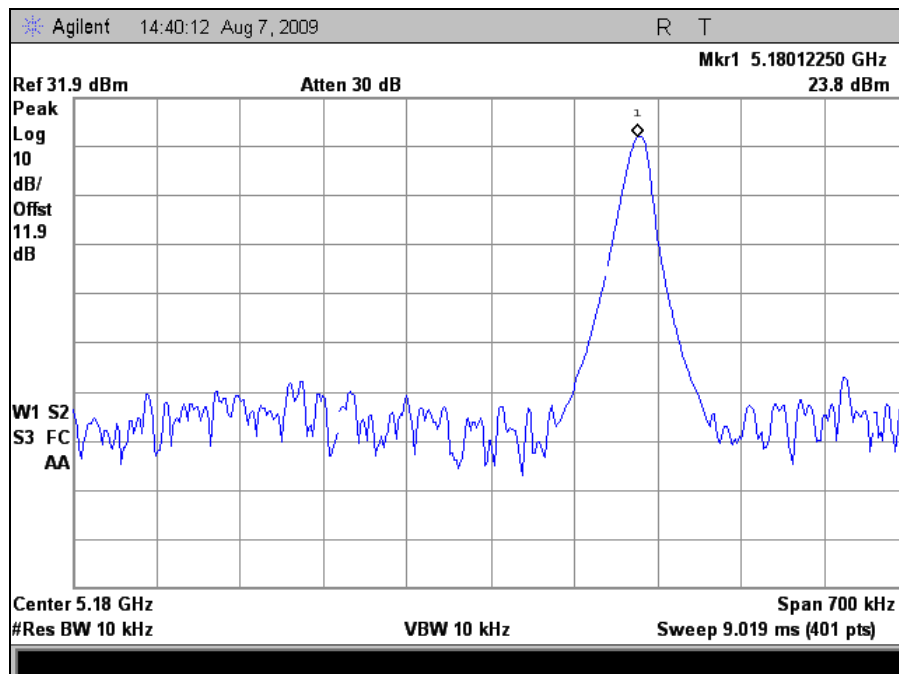
Plot 94. Freq. Stability, Port 3, 5180 MHz @-40C Low Volt.



Plot 95. Freq. Stability, Port 3, 5180 MHz @-40C High Volt.



Plot 96. Freq. Stability, Port 3, 5180 MHz @+60C Low Volt.



Plot 97. Freq. Stability, Port 3, 5180 MHz @+60C High Volt.

## IV. Test Equipment

## Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ANSI/NCSL Z540-1-1994 and ANSI/ISO/IEC 17025:2000.

| MET Asset # | Equipment                        | Manufacturer      | Model           | Last Cal Date | Cal Due Date |
|-------------|----------------------------------|-------------------|-----------------|---------------|--------------|
| 1S2421      | EMI RECEIVER                     | ROHDE&SCHWARZ     | ESIB 7          | 05/27/2009    | 05/27/2010   |
| 1S2121      | PRE-AMPLIFIER                    | HEWLETT PACKARD   | 8449B           | SEE NOTE      |              |
| 1S2198      | HORN ANTENNA                     | EMCO              | 3115            | 09/10/2008    | 09/10/2009   |
| 1S2202      | ANTENNA, HORN, 1 METER           | EMCO              | 3116            | 04/10/2007    | 04/10/2010   |
| N/A         | HIGH PASS FILTER                 | MICRO-TRONICS     | HPM13146        | SEE NOTE      |              |
| 1S2481      | CHAMBER, 10 METER                | ETS-LINDGREN      | DKE 8X8 DBL     | 12/26/2008    | 12/26/2009   |
| 1S2041      | COUPLER, BI DIRECTIONAL COAXIAL  | NARDA             | N/A             | SEE NOTE      |              |
| 1S2460      | ANALYZER, SPECTRUM 9 KHZ-40GHZ   | AGILENT           | E4407B          | 04/14/2009    | 04/14/2010   |
| 1S2034      | COUPLER, DIRECTIONAL 1-20 GHZ    | KRYTAR            | 101020020       | SEE NOTE      |              |
| 1S2464      | LISN                             | SOLAR ELECTRONICS | 9252-50-R24-BNC | 09/26/2008    | 09/26/2009   |
| 1S2512      | TRANSIENT LIMITER                | AGILENT           | 11947A          | SEE NOTE      |              |
| 1S2520      | THERMO-HYGROMETER                | FISHER SCIENTIFIC | 11-661-7D       | 11/14/2007    | 11/13/2009   |
| 1S2482      | CHAMBER, 5 METER                 | PANASHIELD        | 641431          | 11/22/2008    | 11/22/2009   |
| 1S2108      | RECEIVER, EMI, RF FILTER SECTION | HEWLETT PACKARD   | 85460A          | 11/06/2008    | 11/06/2009   |
| 1S2399      | TURNTABLE CONTROLLER             | SUNOL SCIENCE     | SC99V           | SEE NOTE      |              |
| 1S2485      | BILOG ANTENNA                    | TESEQ             | CBL6112D        | 03/20/2009    | 03/20/2010   |
| N/A         | 2-6GHZ COMBINER                  | MINI CIRCUITS     | ZN4PD-1-63-S+   | SEE NOTE      |              |
| 1S2108      | RF FILTER SECTION                | HEWLETT PACKARD   | 85460A          | 11/6/08       | 11/6/09      |
| 1S2041      | COUPLER, BI DIRECTIONAL COAXIAL  | NARDA             | N/A             | SEE NOTE      |              |
| 1S2128      | HARMONIC MIXER                   | HEWLETT PACKARD   | 11970A          | 11/22/2008    | 11/22/2010   |
| 1S2129      | HARMONIC MIXER                   | HEWLETT PACKARD   | 11970K          | 11/22/2008    | 11/22/2010   |

**Table 39. Test Equipment List**

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.



## **V. Certification & User's Manual Information**

## Certification & User's Manual Information

### A. Certification Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart I — Marketing of Radio frequency devices:

#### § 2.801 Radio-frequency device defined.

As used in this part, a radio-frequency device is any device which in its operation is capable of Emitting radio-frequency energy by radiation, conduction, or other means. Radio- frequency devices include, but are not limited to:

- (a) The various types of radio communication transmitting devices described throughout this chapter.
- (b) *The incidental, unintentional and intentional radiators defined in Part 15 of this chapter.*
- (c) The industrial, scientific, and medical equipment described in Part 18 of this chapter.
- (d) Any part or component thereof which in use emits radio-frequency energy by radiation, conduction, or other means.

#### § 2.803 Marketing of radio frequency devices prior to equipment authorization.

- (a) Except as provided elsewhere in this chapter, no person shall sell or lease, or offer for sale or lease (including advertising for sale or lease), or import, ship or distribute for the purpose of selling or leasing or offering for sale or lease, any radio frequency device unless:
  - (1) In the case of a device subject to certification, such device has been authorized by the Commission in accordance with the rules in this chapter and is properly identified and labeled as required by §2.925 and other relevant sections in this chapter; or
  - (2) In the case of a device that is not required to have a grant of equipment authorization issued by the Commission, but which must comply with the specified technical standards prior to use, such device also complies with all applicable administrative (including verification of the equipment or authorization under a Declaration of Conformity, where required), technical, labeling and identification requirements specified in this chapter.
- (d) Notwithstanding the provisions of paragraph (a) of this section, the offer for sale solely to business, commercial, industrial, scientific or medical users (but not an offer for sale to other parties or to end users located in a residential environment) of a radio frequency device that is in the conceptual, developmental, design or pre-production stage is permitted prior to equipment authorization or, for devices not subject to the equipment authorization requirements, prior to a determination of compliance with the applicable technical requirements *provided* that the prospective buyer is advised in writing at the time of the offer for sale that the equipment is subject to the FCC rules and that the equipment will comply with the appropriate rules before delivery to the buyer or to centers of distribution.

- (e)(1) Notwithstanding the provisions of paragraph (a) of this section, prior to equipment authorization or determination of compliance with the applicable technical requirements any radio frequency device may be operated, but not marketed, for the following purposes and under the following conditions:
- (i) *Compliance testing;*
  - (ii) Demonstrations at a trade show provided the notice contained in paragraph (c) of this section is displayed in a conspicuous location on, or immediately adjacent to, the device;
  - (iii) Demonstrations at an exhibition conducted at a business, commercial, industrial, scientific or medical location, but excluding locations in a residential environment, provided the notice contained in paragraphs (c) or (d) of this section, as appropriate, is displayed in a conspicuous location on, or immediately adjacent to, the device;
  - (iv) Evaluation of product performance and determination of customer acceptability, provided such operation takes place at the manufacturer's facilities during developmental, design or pre-production states; or
  - (v) Evaluation of product performance and determination of customer acceptability where customer acceptability of a radio frequency device cannot be determined at the manufacturer's facilities because of size or unique capability of the device, provided the device is operated at a business, commercial, industrial, scientific or medical user's site, but not at a residential site, during the development, design or pre-production stages.
- (e)(2) For the purpose of paragraphs (e)(1)(iv) and (e)(1)(v) of this section, the term *manufacturer's facilities* includes the facilities of the party responsible for compliance with the regulations and the manufacturer's premises, as well as the facilities of other entities working under the authorization of the responsible party in connection with the development and manufacture, but not the marketing, of the equipment.
- (f) For radio frequency devices subject to verification and sold solely to business, commercial, industrial, scientific and medical users (excluding products sold to other parties or for operation in a residential environment), parties responsible for verification of the devices shall have the option of ensuring compliance with the applicable technical specifications of this chapter at each end user's location after installation, provided that the purchase or lease agreement includes a proviso that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.

## Certification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart J — Equipment Authorization Procedures:

### § 2.901 Basis and Purpose

- (a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service wherein the equipment is to be operated.<sup>1</sup> *In addition to the technical standards provided, the rules governing the service may require that such equipment be verified by the manufacturer or importer, be authorized under a Declaration of Conformity, or receive an equipment authorization from the Commission by one of the following procedures: certification or registration.*
- (b) The following sections describe the verification procedure, the procedure for a Declaration of Conformity, and the procedures to be followed in obtaining certification from the Commission and the conditions attendant to such a grant.

### § 2.907 Certification.

- (a) Certification is an equipment authorization issued by the Commission, based on representation and test data submitted by the applicant.
- (b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

---

<sup>1</sup> In this case, the equipment is subject to the rules of Part 15. More specifically, the equipment falls under Subpart B (of Part 15), which deals with unintentional radiators.

## Certification & User's Manual Information

### § 2.948 Description of measurement facilities.

- (a) Each party making measurements of equipment that is subject to an equipment authorization under Part 15 or Part 18 of this chapter, regardless of whether the measurements are filed with the Commission or kept on file by the party responsible for compliance of equipment marketed within the U.S. or its possessions, shall compile a description of the measurement facilities employed.
  - (1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.
    - (i) *If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the Commission by that laboratory. In this situation, the party responsible for the verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.*
    - (ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.
  - (2) If the equipment is to be authorized by the Commission under the certification procedure, the description of the measurement facilities shall be filed with the Commission's Laboratory in Columbia, Maryland. The data describing the measurement facilities need only be filed once but must be updated as changes are made to the measurement facilities or as otherwise described in this section. At least every three years, the organization responsible for filing the data with the Commission shall certify that the data on file is current.

## Certification & User's Manual Information

### Label and User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart A — General:

#### § 15.19 Labeling requirements.

(a) *In addition to the requirements in Part 2 of this chapter, a device subject to certification or verification shall be labeled as follows:*

- (1) Receivers associated with the operation of a licensed radio service, e.g., FM broadcast under Part 73 of this chapter, land mobile operation under Part 90, etc., shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

- (2) A stand-alone cable input selector switch, shall bear the following statement in a conspicuous location on the device:

This device is verified to comply with Part 15 of the FCC Rules for use with cable television service.

- (3) All other devices shall bear the following statement in a conspicuous location on the device:

*This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.*

- (4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.
- (5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

#### § 15.21 Information to user.

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

## Verification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart B — Unintentional Radiators:

### § 15.105 Information to the user.

- (a) For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at own expense.

- (b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

## ICES-003 Procedural & Labeling Requirements

From the Industry Canada Electromagnetic Compatibility Advisory Bulletin entitled, "Implementation and Interpretation of the Interference-Causing Equipment Standard for Digital Apparatus, ICES-003" (EMCAB-3, Issue 2, July 1995):

"At present, CISPR 22: 2002 and ICES technical requirements are essentially equivalent. Therefore, if you have CISPR 22: 2002 approval by meeting CISPR Publication 22, the only additional requirements are: to attach a note to the report of the test results for compliance, indicating that these results are deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations; to maintain these records on file for the requisite five year period; and to provide the device with a notice of compliance in accordance with ICES-003."

### Procedural Requirements:

According to Industry Canada's Interference Causing Equipment Standard for Digital Apparatus ICES-003 Issue 4, February 2004:

- Section 6.1: A record of the measurements and results, showing the date that the measurements were completed, shall be retained by the manufacturer or importer for a period of at least five years from the date shown in the record and made available for examination on the request of the Minister.
- Section 6.2: A written notice indicating compliance must accompany each unit of digital apparatus to the end user. The notice shall be in the form of a label that is affixed to the apparatus. Where because of insufficient space or other constraints it is not feasible to affix a label to the apparatus, the notice may be in the form of a statement in the user's manual.

### Labeling Requirements:

The suggested text for the notice, in English and in French, is provided below, from the Annex of ICES-003:

This Class [<sup>2</sup>] digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe [<sup>1</sup>] est conforme à la norme NMB-003 du Canada.

---

<sup>2</sup> Insert either A or B but not both as appropriate for the equipment requirements.



# End of Report