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

February 10, 2012

Firetide, Inc.
140 Knowles Drive
Los Gatos, CA 95032

Dear Suresh Kumar,

Enclosed is the EMC Wireless test report for compliance testing of the Firetide, Inc., FT 5900 Wireless Mesh Node, tested to the requirements of Title 47 of the Code of Federal Regulations (CFR), Part 90 Subpart 7 for Land Mobile Radio Services and RSS-111, Issue 3, June 2009.

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.\EMCS33266A-FCC90Y Rev. 1)

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Electromagnetic Compatibility Criteria Test Report

For the

Firetide, Inc.
Model FT 5900 Wireless Mesh Node

Tested under

The FCC Verification Rules
Contained in Title 47 of the CFR, Part 90, Subpart Y
for Private Land Mobile Radio Services
and
RSS-111, Issue 3, June 2009

MET Report: EMCS33266A-FCC90Y Rev. 1

February 10, 2012

Prepared For:
Firetide, Inc.
140 Knowles Drive
Los Gatos, CA 95032

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

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RSS-111, Issue 3, June 2009

MET Report: EMCS33266A-FCC90Y Rev. 1

Anderson Soungpanya, 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 / is not capable of operation in accordance with the requirements of Part 90, Subpart Y of the FCC Rules and Industry Canada standard RSS-111, Issue 3, June 2009 under normal use and maintenance.

Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	February 08, 2012	Initial Issue.
1	February 10, 2012	Revised to reflect engineer corrections.

Table of Contents

All references to section numbers are taken directly from the standard/specification used. Only sections requiring testing or evaluation are included.

List of Tables

List of Figures

List of Plots

List of Terms and Abbreviations

AC	**A**lternating **C**urrent
ACF	**A**ntenna **C**orrection **F**actor
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci**b**els
dBµA	**D**eci**b**els above one **micro**amp
dBµV	**D**eci**b**els above one **micro**volt
dBµA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBµV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**ert**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**ert**z**
kPa	**k**ilo**pa**scal
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µH	**microh**enry
µ	**microf**arad
µs	**micros**econds
NEBS	**N**etwork **E**quipment-**B**uilding **S**ystem
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
TWT	**T**raveling **W**ave **T**ube
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane

Executive Summary

1. Testing Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 90, Subpart Y. All tests were conducted using measurement procedure ANSI TIA/EIA-603-A-2004.

Title 47 of the CFR, Part 90, Subpart Y, and FCC 04-265 Reference and Test Description	RSS-111, Issue 3, June 2009 Reference	Conformance			Comments
		Yes	No	N/A	
		Yes - Equipment complies with the Requirement *No - Equipment does not comply with the Requirement* *N/A - Not applicable to the equipment under tests*			
2.1046; 90.1215(a) Peak Power Output	RSS-111, Section 5.3	✓			Measured emissions below applicable limits.
2.1046; 90.1215(a) Peak Power Spectral Density	RSS-111, Section 4.2	✓			Measured emissions below applicable limits.
2.1047(a) Modulation Characteristics	N/A			✓	EUT is non-voice, data only.
2.1049; 90.210(M) Occupied Bandwidth (Emission Mask)	RSS-111, Section 5.3	✓			Measured emissions below applicable limits.
2.1051; 90.210(M) Spurious Emissions at Antenna Terminals	RSS-111, Section 5.4	✓			Measured emissions below applicable limits.
2.1053; 90.210(M) Radiated Spurious Emissions	RSS-111, Section 5.4	✓			Measured emissions below applicable limits.
2.1055(a) (1); 90.213 Frequency Stability over Temperature Variations	RSS-111, Section 5.2	✓			Measured emissions below applicable limits.
2.1055(d) (2) Frequency Stability over Voltage Variations	RSS-111, Section 5.2	✓			Measured emissions below applicable limits.
90.214 Transient Frequency Behavior	RSS-111, Section 5.2			✓	EUT operating frequency is at 4.9 GHz.

Equipment Configuration

2. Equipment Configuration

2.1. Overview

MET Laboratories, Inc. was contracted by Firetide, Inc. to perform testing on the FT 5900 Wireless Mesh Node under purchase order number PO-3077.

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.., FT 5900 Wireless Mesh Node.

An EMC evaluation to determine compliance of the TB 4.9 with the requirements of Part 90, Subpart Y, was conducted. (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 TB4.9. Firetide, Inc. should retain a copy of this document and it should be kept on file for at least five years after the manufacturing of the EUT has been **permanently** discontinued. The results obtained relate only to the item(s) tested.

Model(s) Tested:	FT 5900 Wireless Mesh Node	
Model(s) Covered:	FT 5900 Wireless Mesh Node	
EUT Specifications:	Primary Power Source: 230VAC	
	FCC ID: REP-5900-1 IC: 4988A-5900	
	Type of Modulations:	OFDM (Orthogonal Frequency Division multiplexing)
	Peak Output Power:	24.67dBm
	Equipment Code:	TNB
	EUT Frequency Ranges:	4945 – 4980 MHz
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature (15-35º C):	
	Relative Humidity (30-60%):	
	Barometric Pressure (860-1060 mbar):	
Evaluated by:	Anderson Soungpanya	
Report Date(s):	February 10, 2012	

2.2. 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 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.

2.3. Description of Test Sample

The Firetide, Inc. FT 5900 Wireless Mesh Node, Equipment Under Test (EUT), provide reliable Ethernet connectivity over a high performance, self-forming wireless mesh backbone. All nodes have an Ethernet port for connecting network devices or other networks to the wireless mesh. 5900 mesh features a dual radio solution with capability of operating in the 900 MHz spectrum on one radio while concurrently operating in the 2.4 GHz, 4.9 GHz (U.S. public safety licensed band) or 5 GHz frequency ranges on the other.

2.4. 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	Name / Description	Model Number	Serial Number
1	Unit Enclosure	--	--
2	DC Power Board	GS260A12	EB14145528
3	Dual Radio Mother Board	FT5900	--
	9dBi Omni Antenna	MA-WO55-MIMONHFT9	430
	15dBi Sector Antenna	MA-WE55-MIMOFT15	327
	16dBi Panel Antenna	MA-WD56-DSV16	623

Table 1. Equipment Configuration

2.5. Support Equipment

Firetide, Inc. supplied support equipment necessary for the operation and testing of the FT 5900 Wireless Mesh Node. All support equipment supplied is listed in the following Support Equipment List.

Name / Description	Manufacturer	Model Number	Serial Number
External DC Adapter	Mean Well	GS60A12-P1J	NA
Laptop computer	Dell	vostro 1000	N/A

Table 2. Support Equipment

2.6. Ports and Cabling Information

Port name on EUT	Cable Description or reason for no cable	Qty.	Length (m)	Shielded? (Y/N)	Termination Box ID & Port ID
RJ45 Port	Ethernet Cable	1	--	N	Laptop
Serial Port	Serial Cable	1	--	Y	Laptop
DC Power Input Port	Power Cable	1	--	Y	DC Adapter

Table 3. Ports and Cabling Information

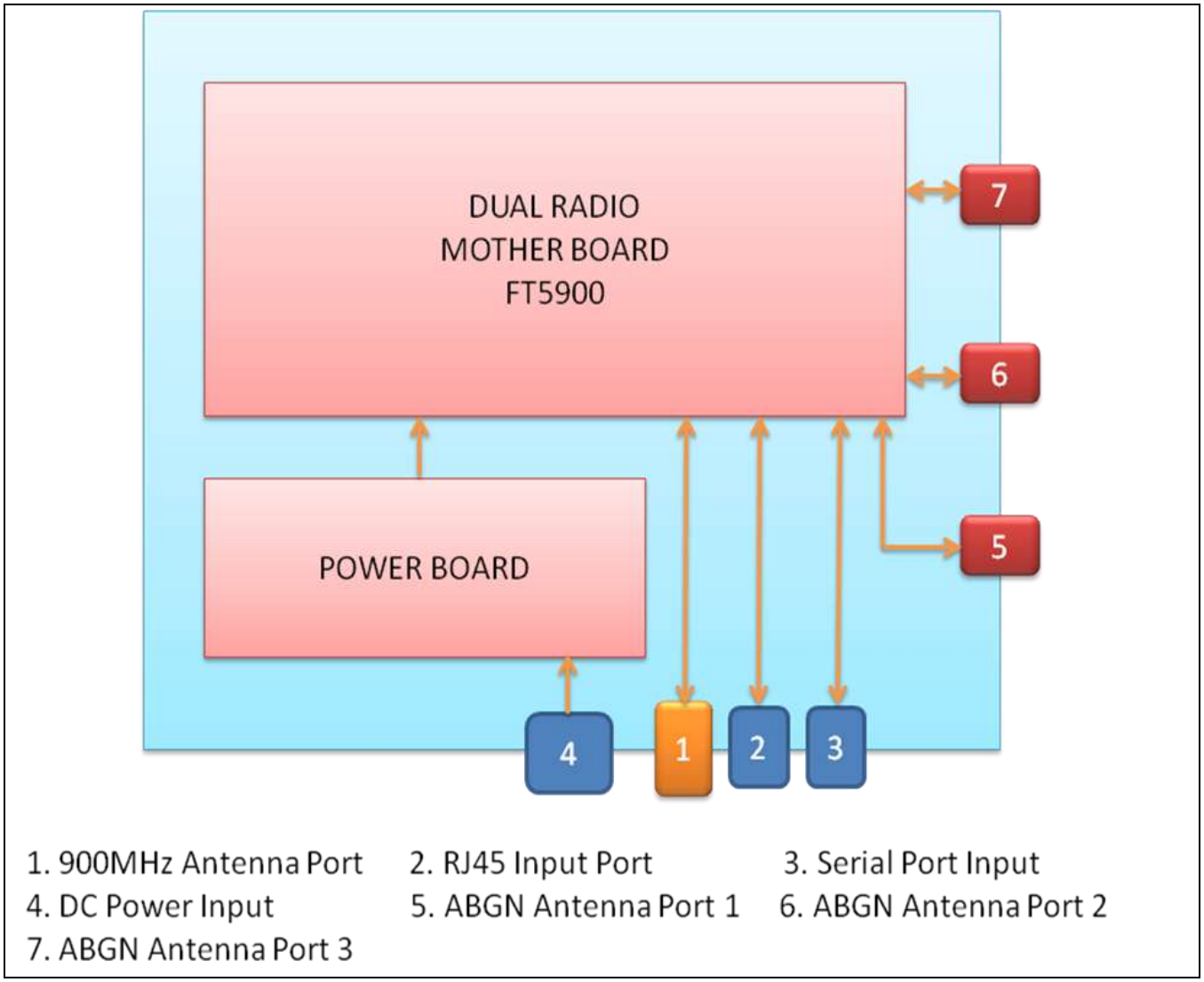


Figure 1. Block Diagram of Test Configuration

2.7. Method of Monitoring EUT Operation

Once the DC power is applied on board LED indicates to mention that the unit is powered on properly. . Proper IP address should be set in the PC prior to the Ethernet cable connection. The Ethernet connectivity needs to be made by connecting an Ethernet cable. Once the connection is established, you can verify this in the PC's LAN connectivity status. Proper IP address should be set in the PC prior to the Ethernet cable connection.

2.8. Modifications

2.8.1. Modifications to EUT

No modifications were made to the EUT.

2.8.2. Modifications to Test Standard

No modifications were made to the test standard.

2.9. 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 Intentional Radiators

3. Electromagnetic Compatibility RF Power Output Requirements

3.1. RF Power Output

Test Requirement(s): **§2.1046 and §90.1215(a) with FCC 04-265**

Test Procedures: As required by 47 CFR 2.1046, *RF power output measurements* were made at the RF output terminals using a Spectrum Analyzer.

A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected to a Spectrum Analyzer via an attenuator to measure the Peak power. The EUT power was adjusted enough to produce maximum output power as specified in the owner's manual. The output power was then recorded with peak reading. Measurements were made at the low, mid and high channels.

Test Results: Equipment complies with 47CFR 2.1046 and 90.1215(a) with FCC 04-265.

All RF Power output measurements were direct connection to RF output Terminal of EUT from a Spectrum Analyzer.

Test Engineer(s): Anderson Soungpanya

Test Date(s): 12/23/11

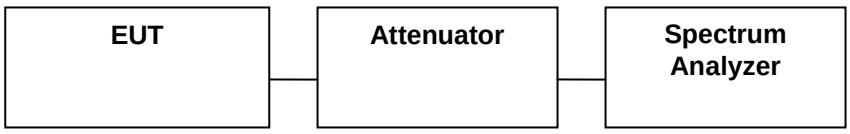


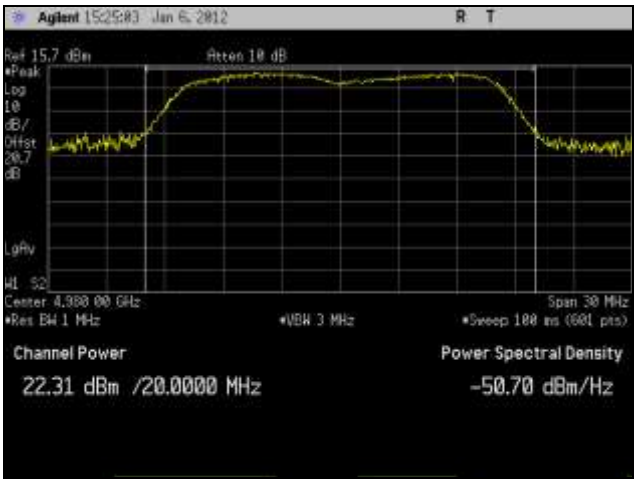
Figure 2. RF Power Output Test Setup

Peak Conducted Output Power							
Mode	**Carrier Channel**	**Frequency (MHz)**	**Measured Peak Output Power (dBm) Port 1**	**Measured Peak Output Power (dBm) Port 2**	**Measured Peak Output Power (dBm) Port 3**	**Combined Peak Output Power (dBm)**	**Limit (dBm)**
802.11a	Low	4950	22.88	--	--	--	33.00
	High	4980	22.31	--	--	--	33.00
802.11n 10 MHz	Low	4945	22.64	21.09	21.54	26.578	30.00
	Mid	4965	21.20	21.25	20.80	25.859	30.00
	High	4985	21.24	21.49	22.27	26.460	30.00
802.11n 20 MHz	Low	4950	16.32	18.79	18.81	22.891	33.00
	High	4980	18.99	18.51	18.33	23.390	33.00

Table 4. RF Power Output, Test Results

RF Power Output, 802.11a

Plot 1. RF Power Output, Low Channel, 802.11a



Plot 2. RF Power Output, High Channel, 802.11a

RF Power Output, 802.11n 10 MHz, Port 1

Plot 3. RF Power Output, Low Channel, 802.11n 10 MHz, Port 1

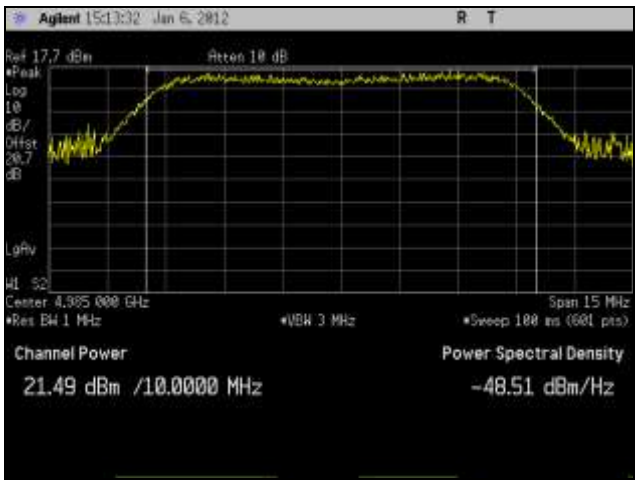
Plot 4. RF Power Output, Mid Channel, 802.11n 10 MHz, Port 1

Plot 5. RF Power Output, High Channel, 802.11n 10 MHz, Port 1

RF Power Output, 802.11n 10 MHz, Port 2

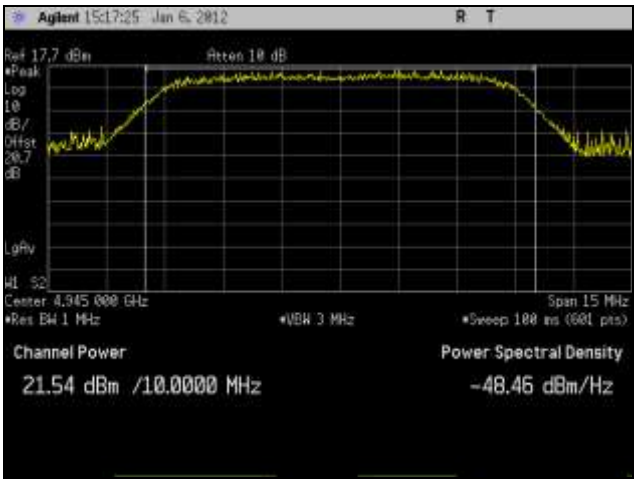
Plot 6. RF Power Output, Low Channel, 802.11n 10 MHz, Port 2

Plot 7. RF Power Output, Mid Channel, 802.11n 10 MHz, Port 2



Plot 8. RF Power Output, High Channel, 802.11n 10 MHz, Port 2

RF Power Output, 802.11n 10 MHz, Port 3

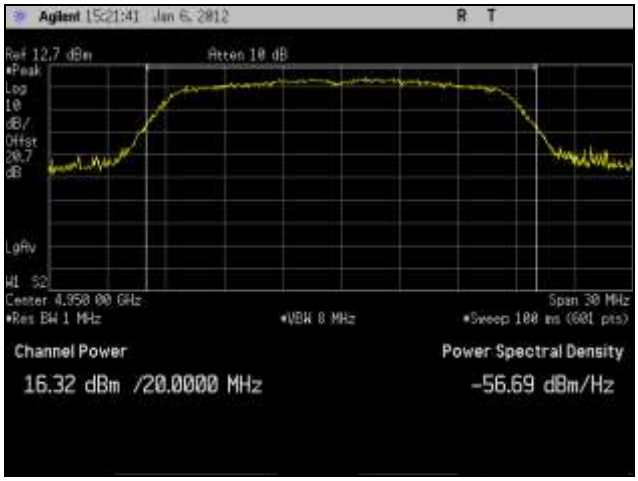


Plot 9. RF Power Output, Low Channel, 802.11n 10 MHz, Port 3

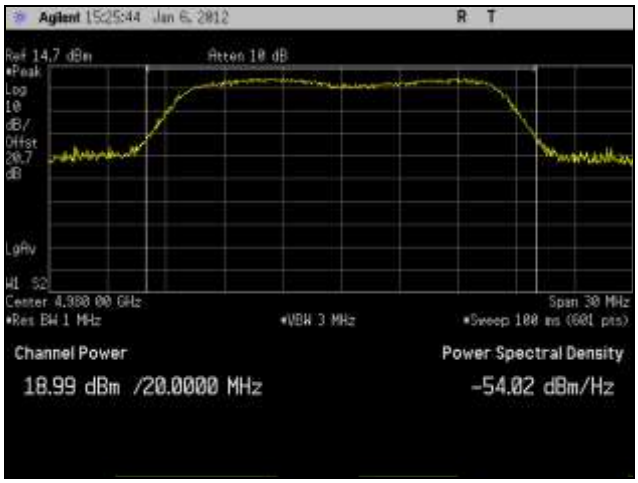
Plot 10. RF Power Output, Mid Channel, 802.11n 10 MHz, Port 3

Plot 11. RF Power Output, High Channel, 802.11n 10 MHz, Port 3

RF Power Output, 802.11n 20 MHz, Port 1



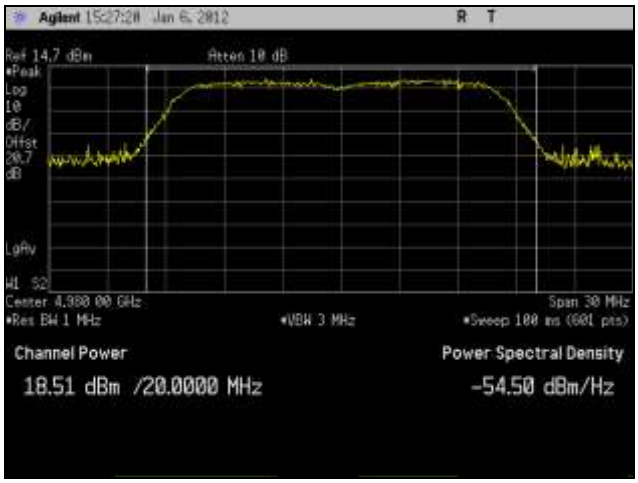
Plot 12. RF Power Output, Low Channel, 802.11n 20 MHz, Port 1



Plot 13. RF Power Output, High Channel, 802.11n 20 MHz, Port 1

RF Power Output, 802.11n 20 MHz, Port 2

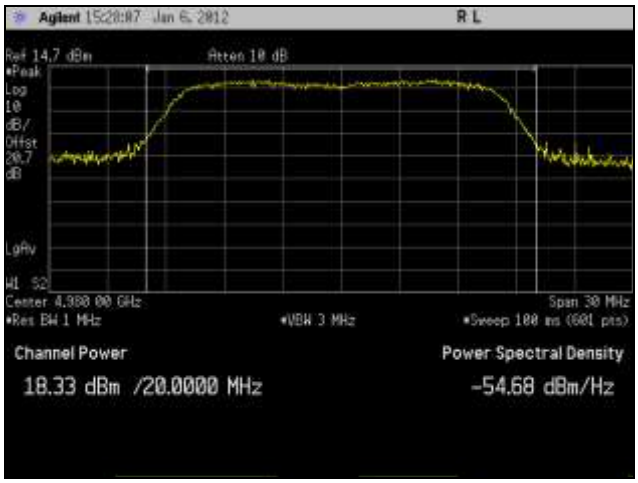
Plot 14. RF Power Output, Low Channel, 802.11n 20 MHz, Port 2



Plot 15. RF Power Output, High Channel, 802.11n 20 MHz, Port 2

RF Power Output, 802.11n 20 MHz, Port 3

Plot 16. RF Power Output, Low Channel, 802.11n 20 MHz, Port 3



Plot 17. RF Power Output, High Channel, 802.11n 20 MHz, Port 3

3.2. Peak Power Spectral Density

Test Requirement(s): **§90.1215(a) with FCC 04-265**

Test Procedures: As required by 47 CFR 2.1046, *RF power output measurements* were made at the RF output terminals using a Directional Coupler through a Spectrum Analyzer and Power Meter.

A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected to a Spectrum Analyzer in order to measure the power level. The Spectrum Analyzer was set to a RBW = 1 & VBW = 3 MHz. The EUT power was adjusted at the maximum output power level. The max hold key from the Spectrum Analyzer was activated capturing the modulated envelope of the EUT. The Peak Power Spectral Density was then recorded. Measurements were made at the low, mid and high channels.

Test Results: Equipment complies with 47 CFR 2.1046 and 90.1215(a) with FCC 04-265 (High Power devices). The EUT does not exceed a combined 21dBm/MHz peak power spectral density (16.23dBm/MHz per port) at the carrier frequency.

The following pages show measurements of Peak Power Spectral Density plots which is recorded below:

Test Engineer(s): Lionel Gabrillo

Test Date(s): 12/23/11

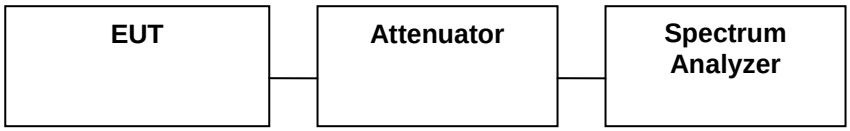
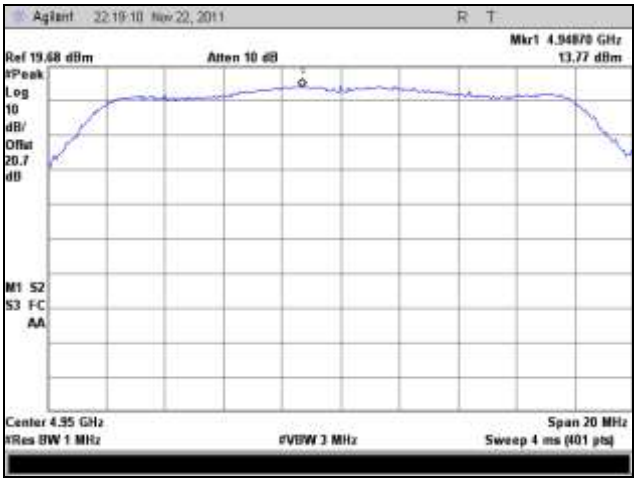


Figure 3. Peak Spectral Density Test Setup

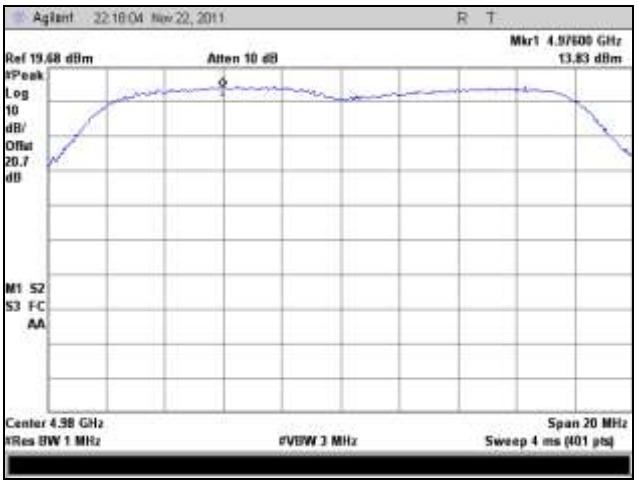
Frequency (MHz)	EUT Channel Bandwidth (MHz)	Measured Power Spectral Density (dBm) Port 1	Measured Power Spectral Density (dBm) Port 2	Measured Power Spectral Density (dBm) Port 3	Sum (dBm)	Limit (dBm)
4950	802.11a	13.77	--	--	--	21.00
4980		13.83	--	--	--	21.00
4945	802.11n 10 MHz	16.26	15.79	15.24	20.554	21.00
4965		16.12	15.74	16.20	20.796	21.00
4985		16.25	15.40	16.06	20.690	21.00
4950	802.11n 20 MHz	9.112	8.25	8.75	13.490	21.00
4980		8.681	8.514	9.086	13.538	21.00

Table 5. Peak Power Spectral Density, Test Results

Peak Power Spectral Density, 802.11a

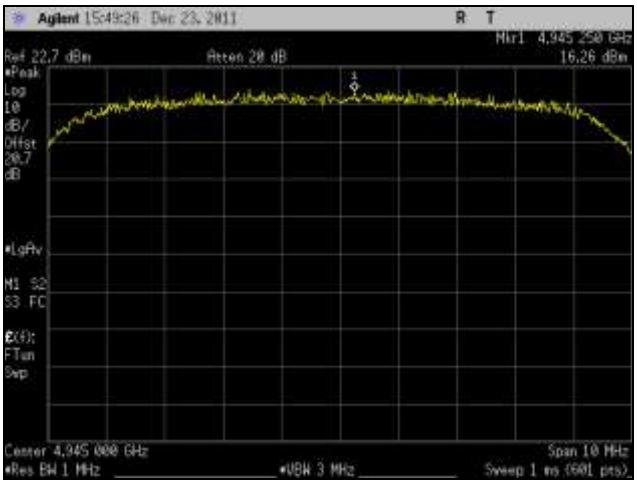


Plot 18. Peak Spectral Density, Low Channel, 802.11a

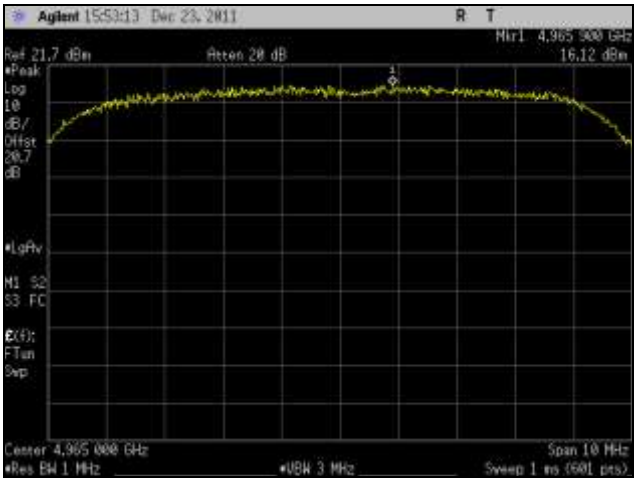


Plot 19. Peak Spectral Density, High Channel, 802.11a

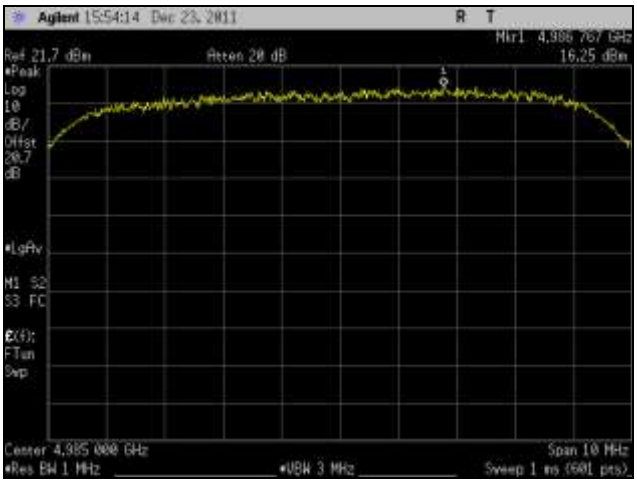
Peak Power Spectral Density, 802.11n 10 MHz, Port 1



Plot 20. Peak Spectral Density, Low Channel, 802.11n 10 MHz, Port 1

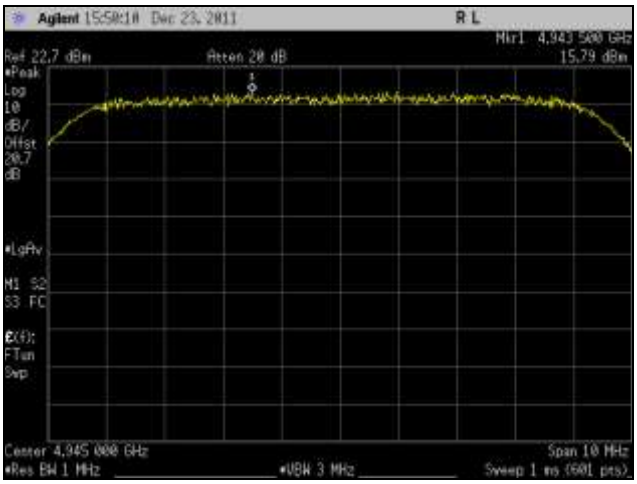


Plot 21. Peak Spectral Density, Mid Channel, 802.11n 10 MHz, Port 1

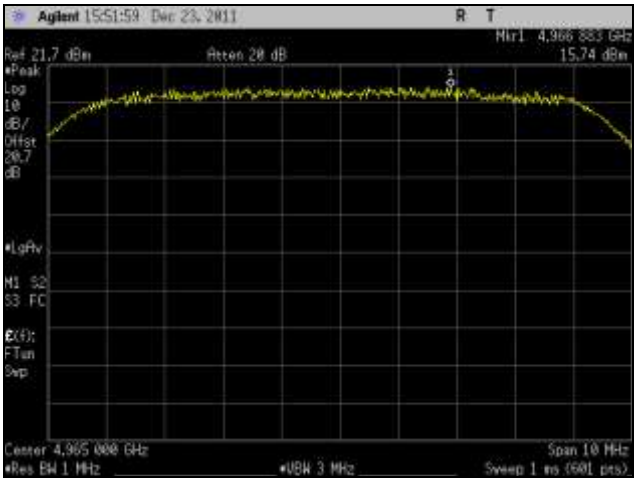


Plot 22. Peak Spectral Density, High Channel, 802.11n 10 MHz, Port 1

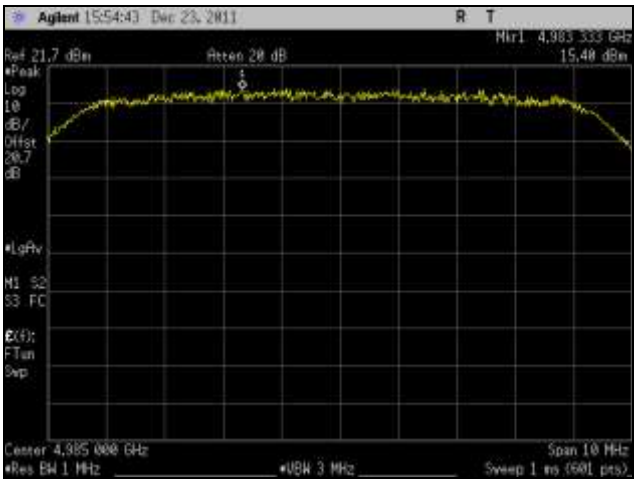
Peak Power Spectral Density, 802.11n 10 MHz, Port 2



Plot 23. Peak Spectral Density, Low Channel, 802.11n 10 MHz, Port 2

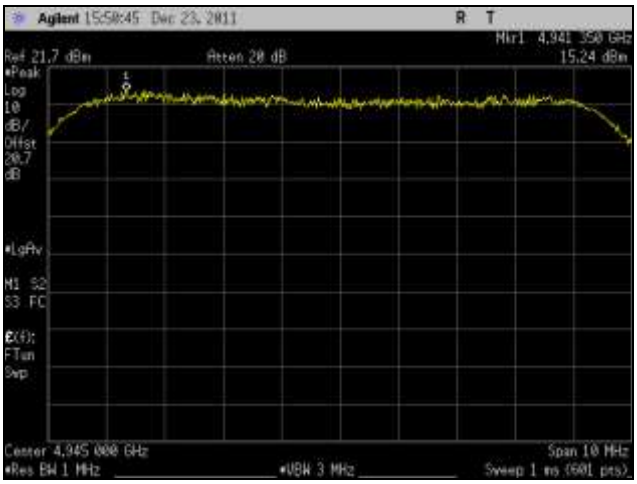


Plot 24. Peak Spectral Density, Mid Channel, 802.11n 10 MHz, Port 2

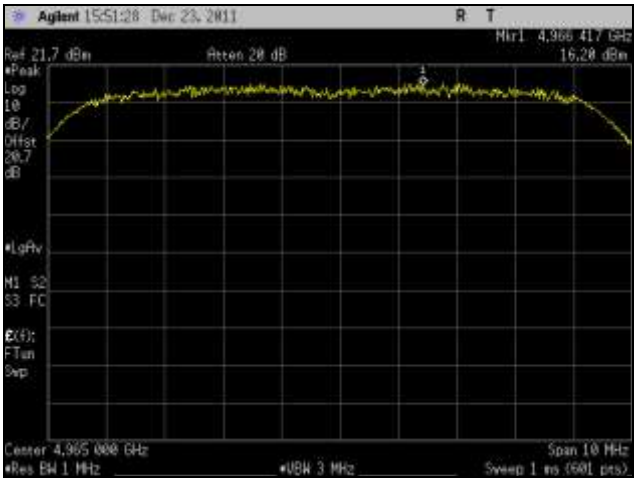


Plot 25. Peak Spectral Density, High Channel, 802.11n 10 MHz, Port 2

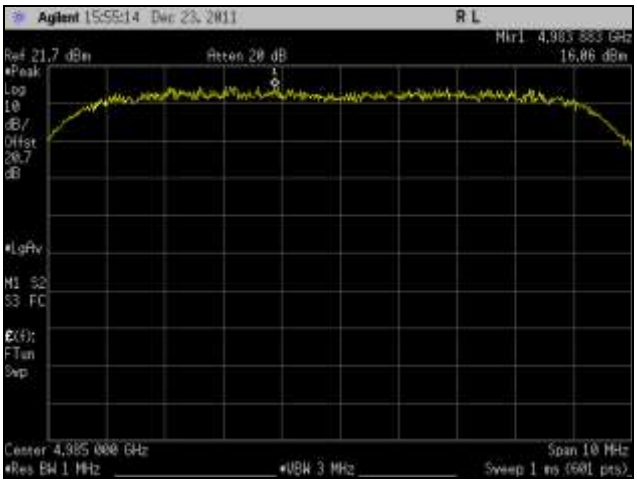
Peak Power Spectral Density, 802.11n 10 MHz, Port 3



Plot 26. Peak Spectral Density, Low Channel, 802.11n 10 MHz, Port 3

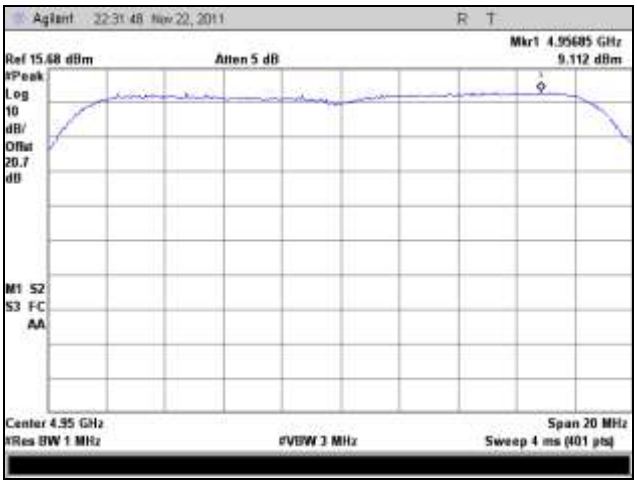


Plot 27. Peak Spectral Density, Mid Channel, 802.11n 10 MHz, Port 3

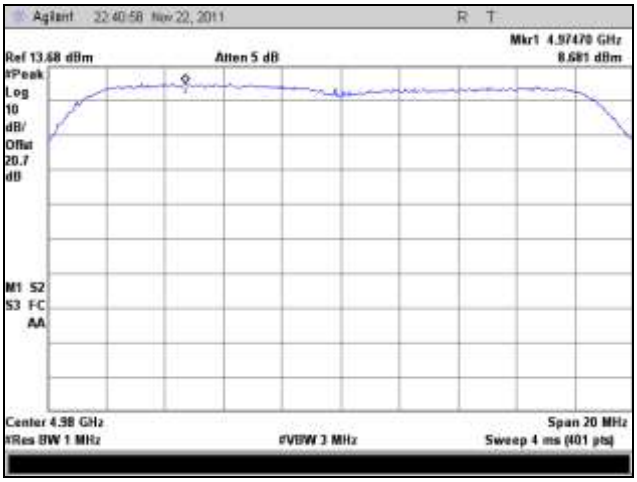


Plot 28. Peak Spectral Density, High Channel, 802.11n 10 MHz, Port 3

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

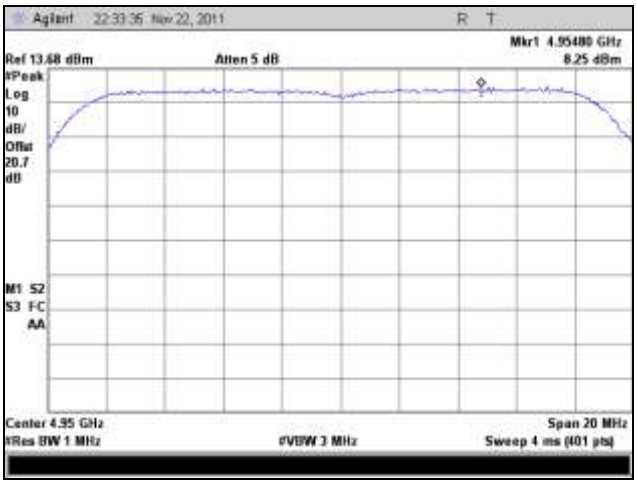


Plot 29. Peak Spectral Density, Low Channel, 802.11n 20 MHz, Port 1

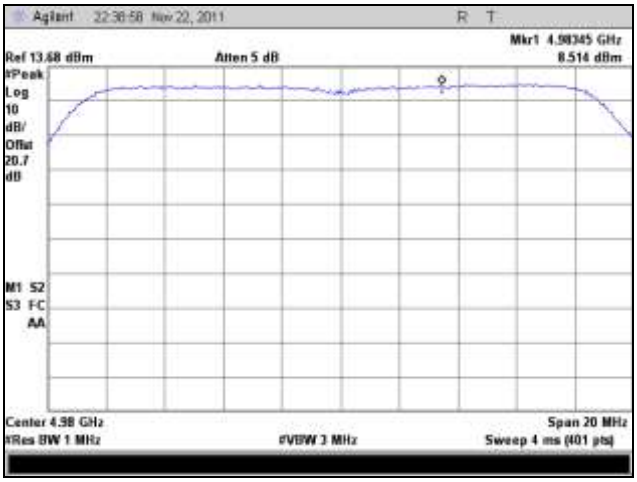


Plot 30. Peak Spectral Density, High Channel, 802.11n 20 MHz, Port 1

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

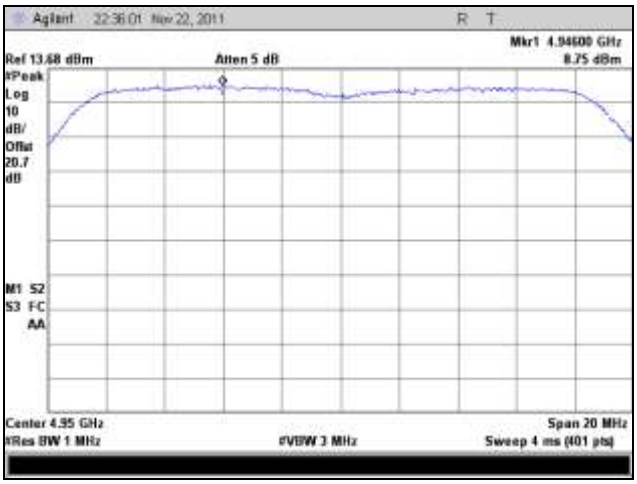


Plot 31. Peak Spectral Density, Low Channel, 802.11n 20 MHz, Port 2

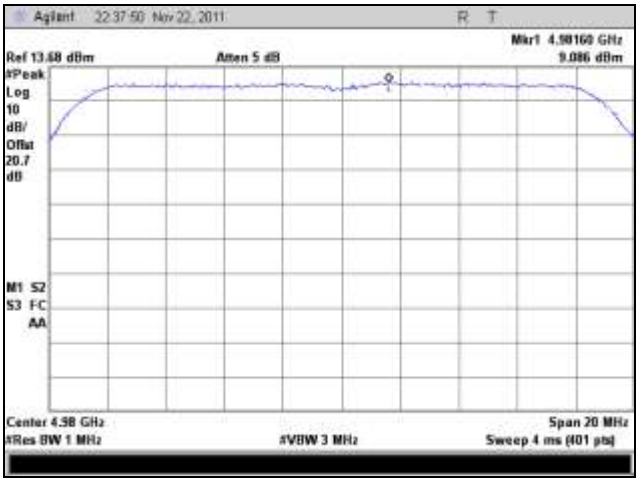


Plot 32. Peak Spectral Density, High Channel, 802.11n 20 MHz, Port 2

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



Plot 33. Peak Spectral Density, Low Channel, 802.11n 20 MHz, Port 3



Plot 34. Peak Spectral Density, High Channel, 802.11n 20 MHz, Port 3

4. Electromagnetic Compatibility Occupied Bandwidth Requirements

4.1. Occupied Bandwidth (Emission Mask)

Test Requirement(s): **§2.1049 and §90.210 (M) with FCC 04-265 (Emissions Mask M)**

Test Procedures: As required by 47 CFR 2.1049, *occupied bandwidth measurements* were made at the RF output terminals using a Spectrum Analyzer.

A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected to a Spectrum Analyzer via attenuator. The measured highest Average Power was set relative to zero dB reference. The RBW of the Spectrum Analyzer was set to at least 1% of the channel bandwidth. The EUT power was adjusted at the maximum output power level. Measurements were carried out at the low, mid and high channels of the TX band.

Test Results: Equipment complies with Section 2.1049 and 90.210(M) with FCC 04-265 (Emission Mask M). The EUT does not exceed the Emission Masks limit.

The following pages show measurements of Emission Mask plots:

Test Engineer(s): Lionel Gabrillo

Test Date(s): 12/23/11

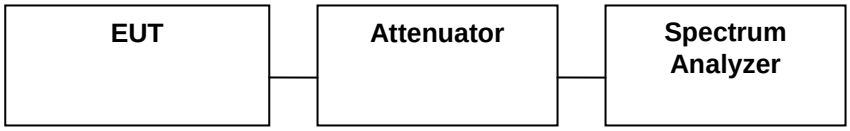
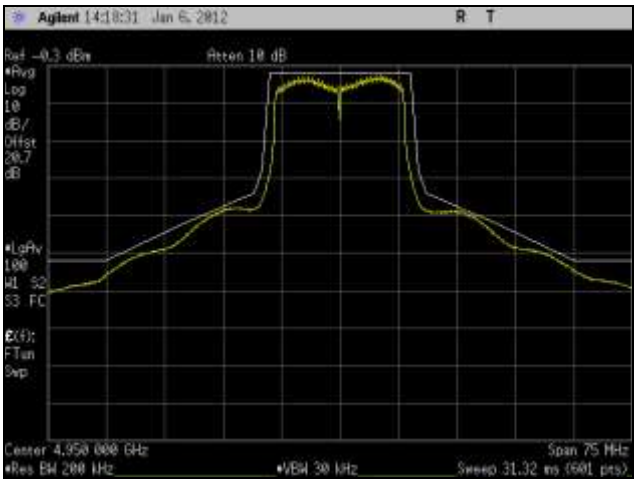
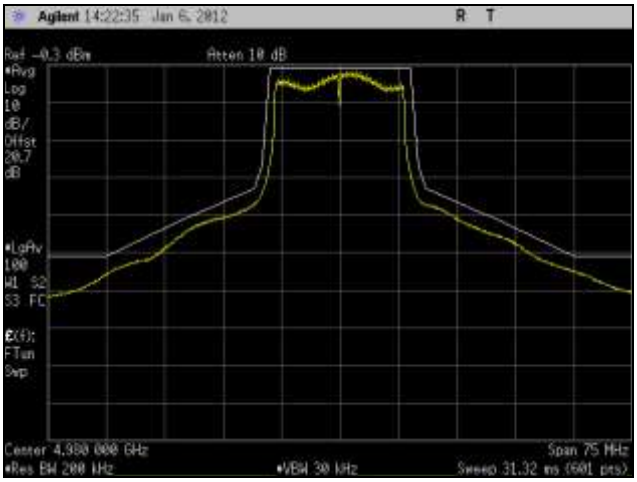


Figure 4. Occupied Bandwidth (Emission Mask) Test Setup

Emission Mask, 802.11a

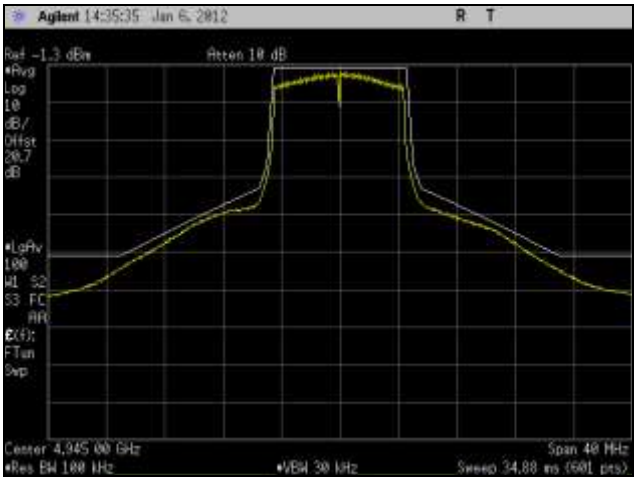


Plot 35. Emission Mask, Low Channel, 802.11a

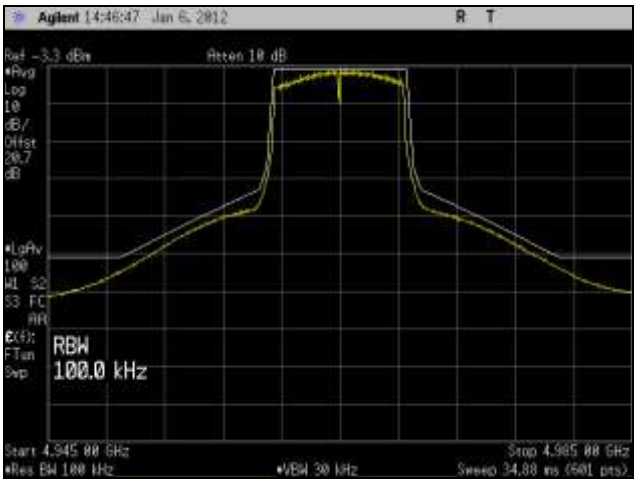


Plot 36. Emission Mask, High Channel, 802.11a

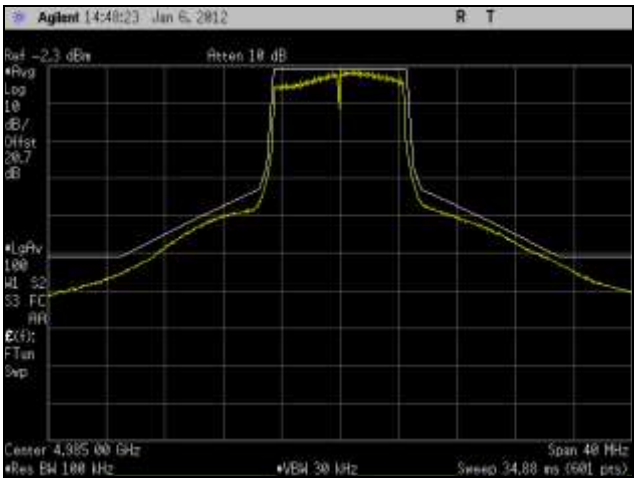
Emission Mask, 802.11n 10 MHz, Port 1



Plot 37. Emission Mask, Low Channel, 802.11n 10 MHz, Port 1

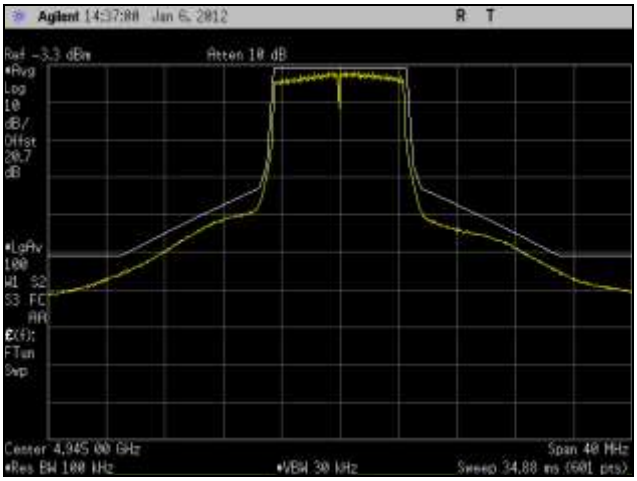


Plot 38. Emission Mask, Mid Channel, 802.11n 10 MHz, Port 1

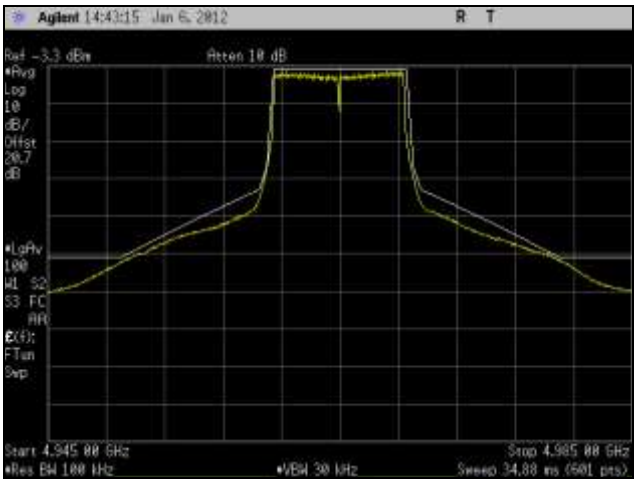


Plot 39. Emission Mask, High Channel, 802.11n 10 MHz, Port 1

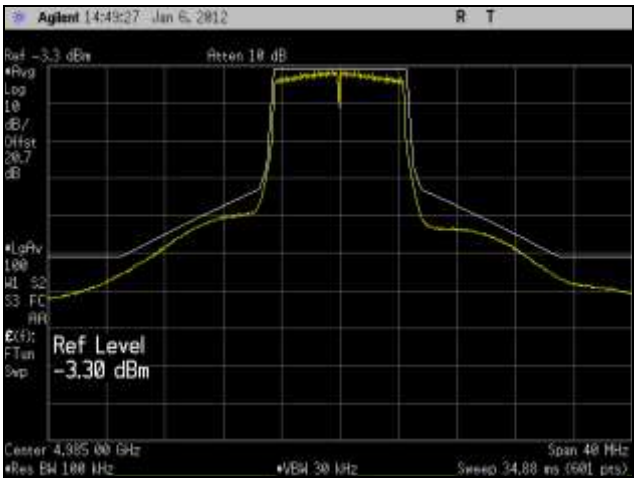
Emission Mask, 802.11n 10 MHz, Port 2



Plot 40. Emission Mask, Low Channel, 802.11n 10 MHz, Port 2

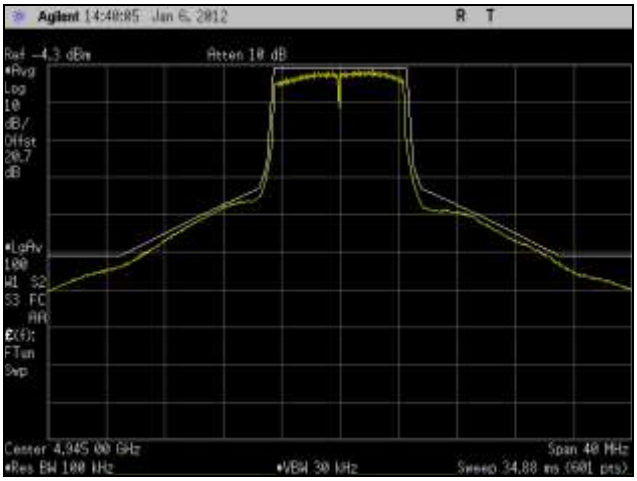


Plot 41. Emission Mask, Mid Channel, 802.11n 10 MHz, Port 2

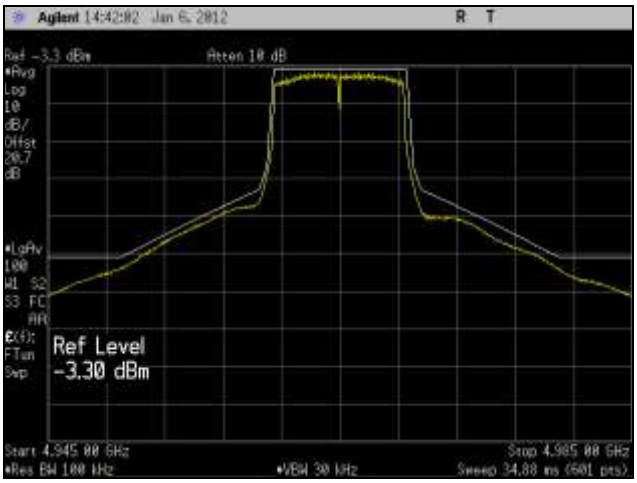


Plot 42. Emission Mask, High Channel, 802.11n 10 MHz, Port 2

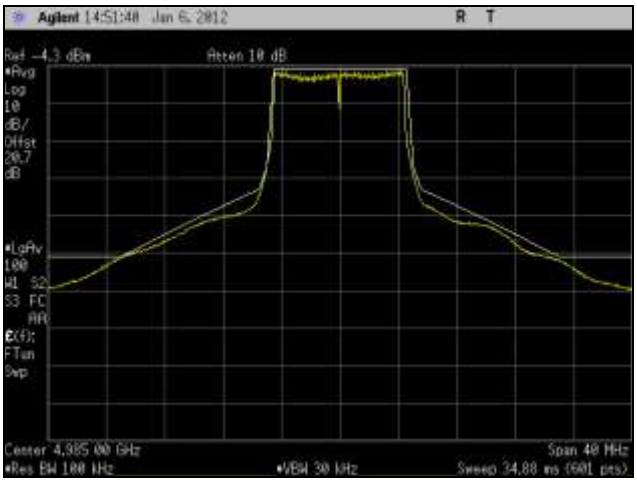
Emission Mask, 802.11n 10 MHz, Port 3



Plot 43. Emission Mask, Low Channel, 802.11n 10 MHz, Port 3

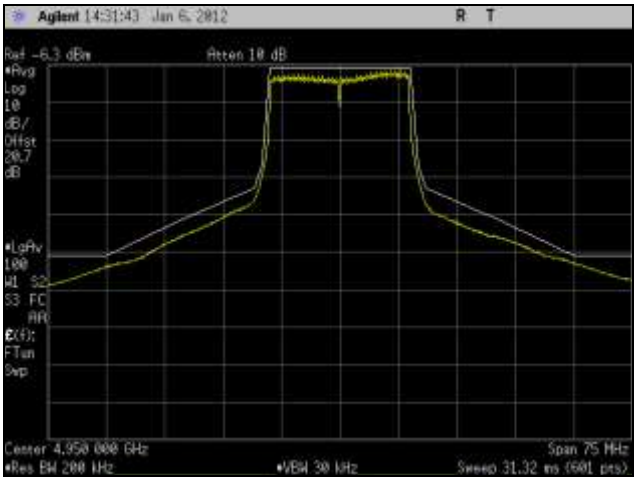


Plot 44. Emission Mask, Mid Channel, 802.11n 10 MHz, Port 3

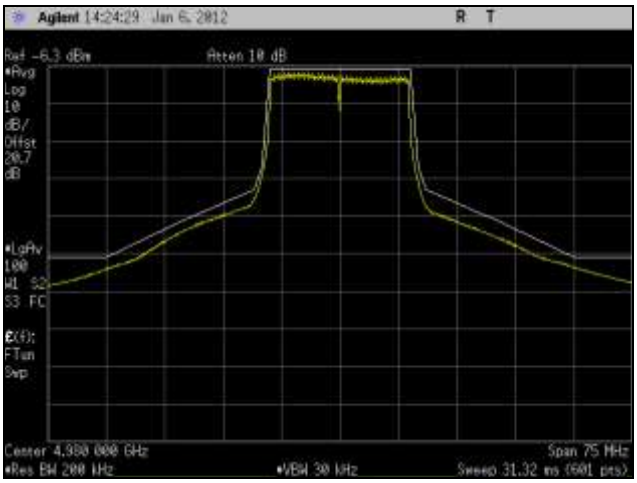


Plot 45. Emission Mask, High Channel, 802.11n 10 MHz, Port 3

Emission Mask, 802.11n 20 MHz, Port 1

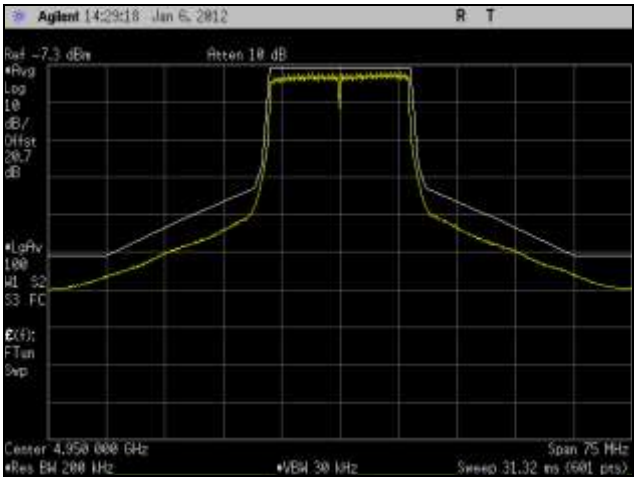


Plot 46. Emission Mask, Low Channel, 802.11n 20 MHz, Port 1

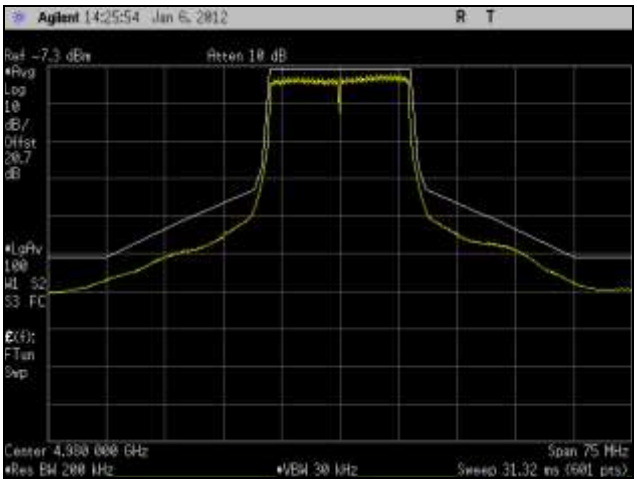


Plot 47. Emission Mask, High Channel, 802.11n 20 MHz, Port 1

Emission Mask, 802.11n 20 MHz, Port 2

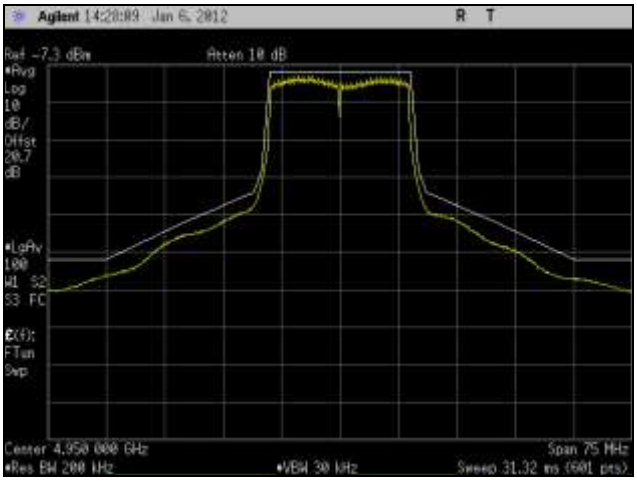


Plot 48. Emission Mask, Low Channel, 802.11n 20 MHz, Port 2

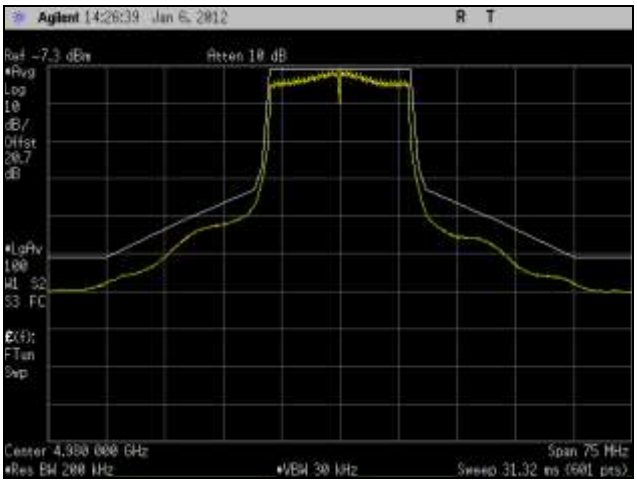


Plot 49. Emission Mask, High Channel, 802.11n 20 MHz, Port 2

Emission Mask, 802.11n 20 MHz, Port 3

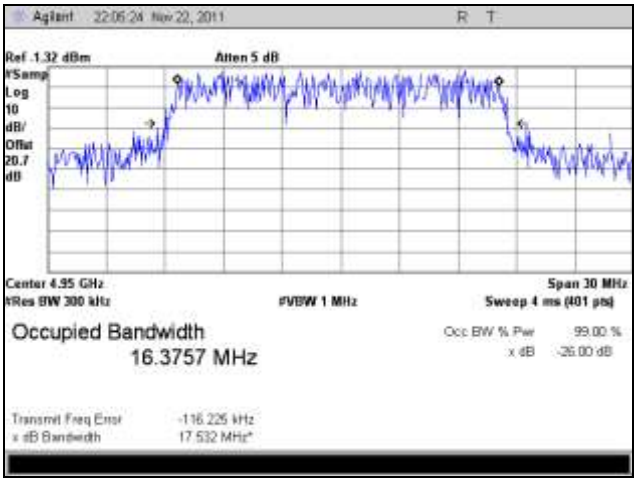


Plot 50. Emission Mask, Low Channel, 802.11n 20 MHz, Port 3

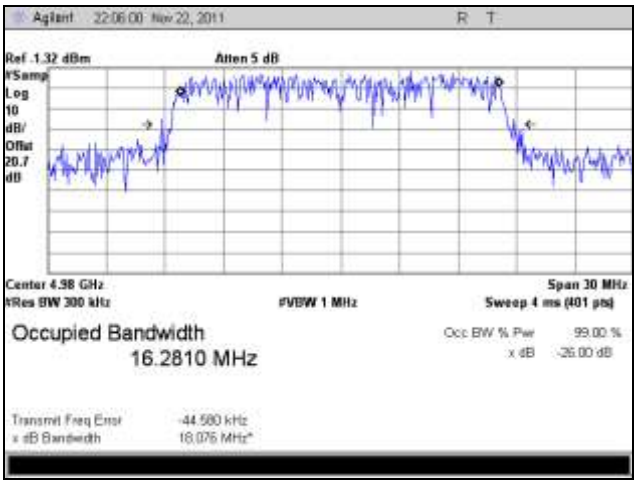


Plot 51. Emission Mask, High Channel, 802.11n 20 MHz, Port 3

99% Occupied Bandwidth, 802.11a

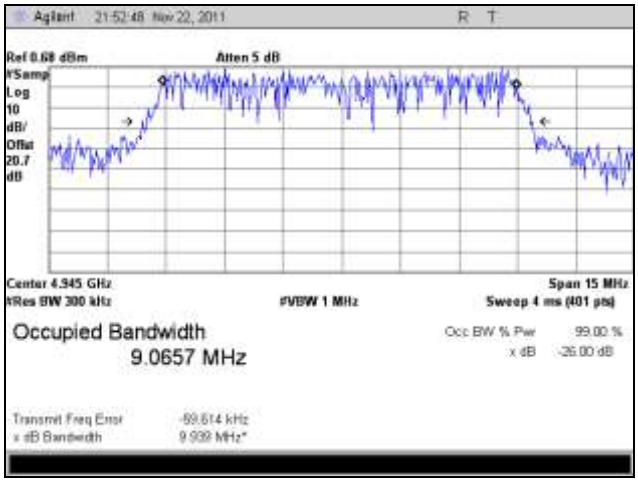


Plot 52. 99% Occupied Bandwidth, Low Channel, 802.11a

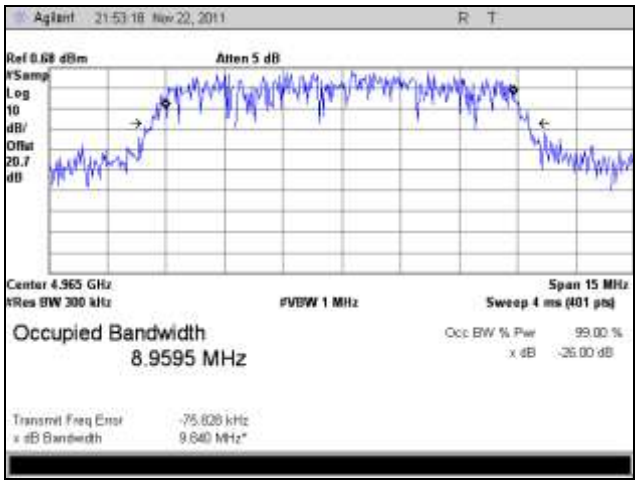


Plot 53. 99% Occupied Bandwidth, High Channel, 802.11a

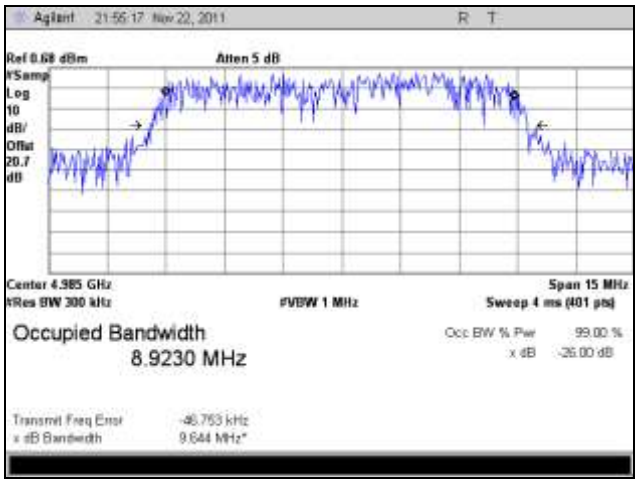
99% Occupied Bandwidth, 802.11n 10 MHz, Port 1



Plot 54. 99% Occupied Bandwidth, Low Channel, 802.11n 10 MHz, Port 1

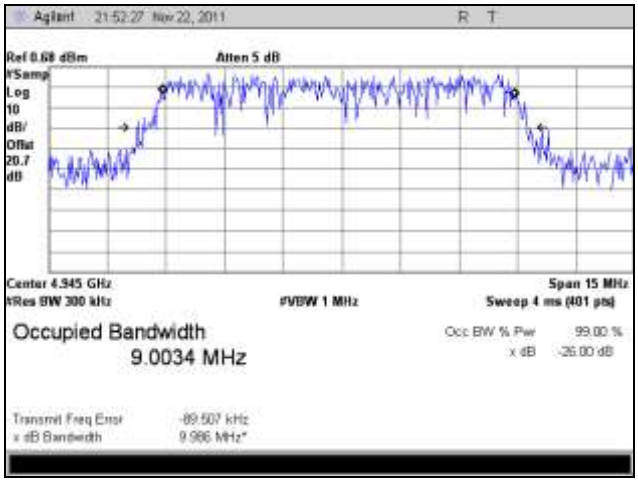


Plot 55. 99% Occupied Bandwidth, Mid Channel, 802.11n 10 MHz, Port 1

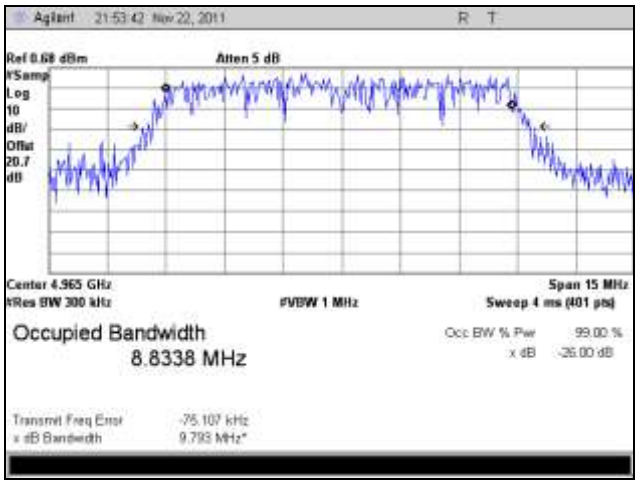


Plot 56. 99% Occupied Bandwidth, High Channel, 802.11n 10 MHz, Port 1

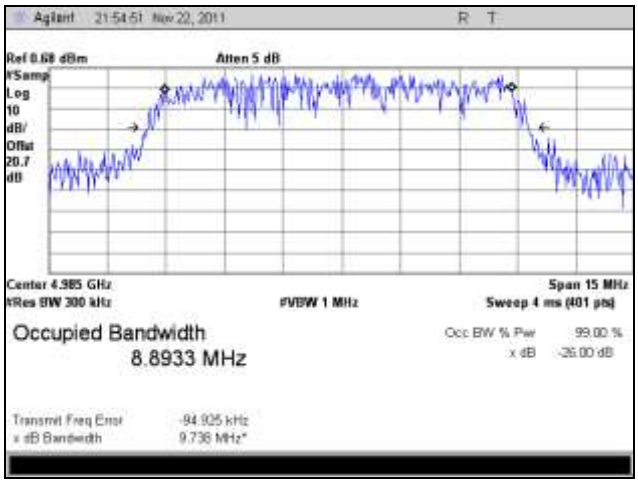
99% Occupied Bandwidth, 802.11n 10 MHz, Port 2



Plot 57. 99% Occupied Bandwidth, Low Channel, 802.11n 10 MHz, Port 2

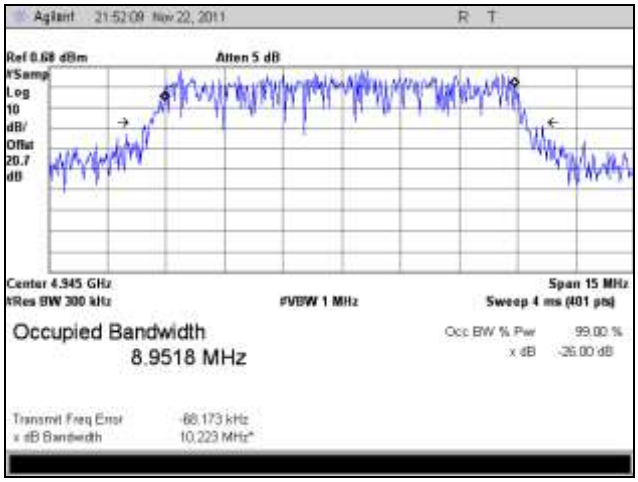


Plot 58. 99% Occupied Bandwidth, Mid Channel, 802.11n 10 MHz, Port 2

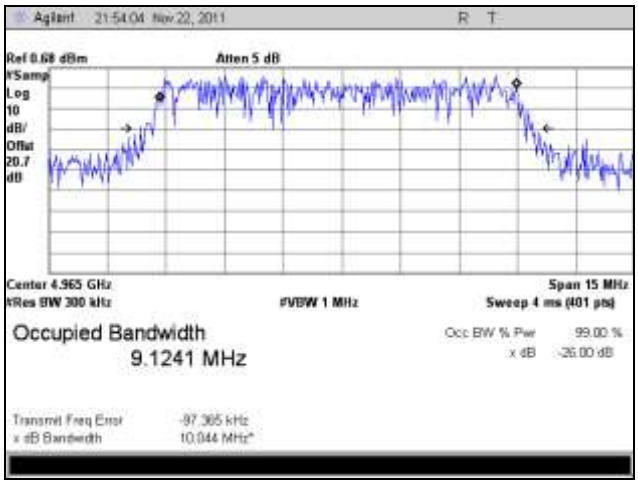


Plot 59. 99% Occupied Bandwidth, High Channel, 802.11n 10 MHz, Port 2

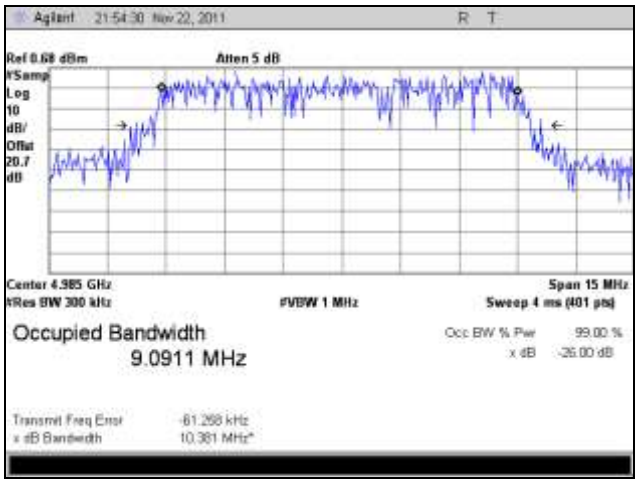
99% Occupied Bandwidth, 802.11n 10 MHz, Port 3



Plot 60. 99% Occupied Bandwidth, Low Channel, 802.11n 10 MHz, Port 3

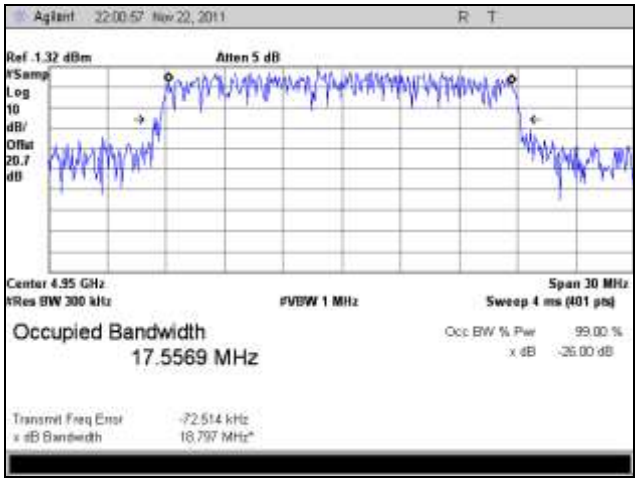


Plot 61. 99% Occupied Bandwidth, Mid Channel, 802.11n 10 MHz, Port 3

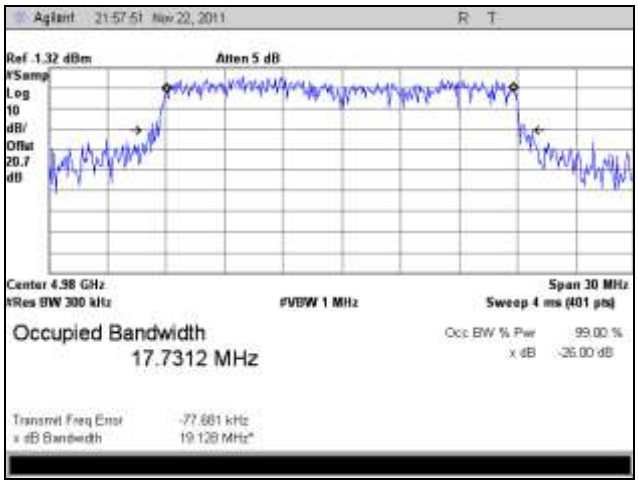


Plot 62. 99% Occupied Bandwidth, High Channel, 802.11n 10 MHz, Port 3

99% Occupied Bandwidth, 802.11n 20 MHz, Port 1

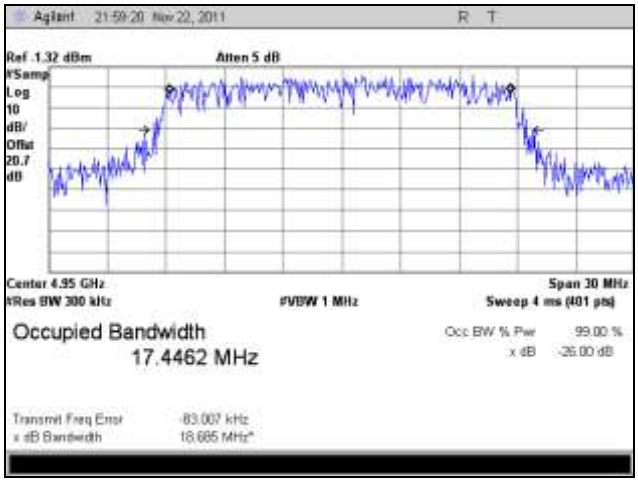


Plot 63. 99% Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port 1

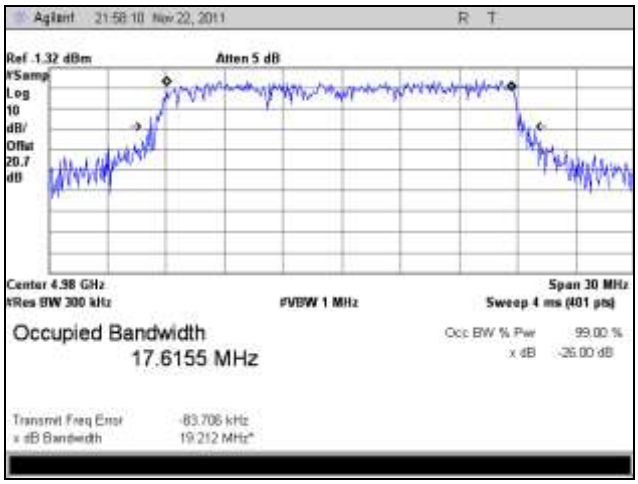


Plot 64. 99% Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port 1

99% Occupied Bandwidth, 802.11n 20 MHz, Port 2

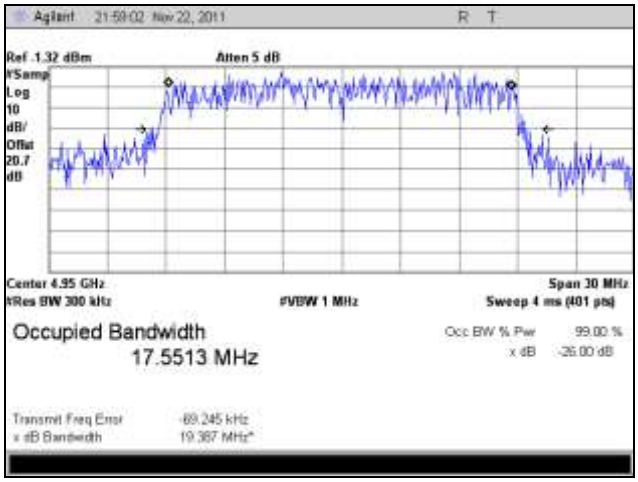


Plot 65. 99% Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port 2

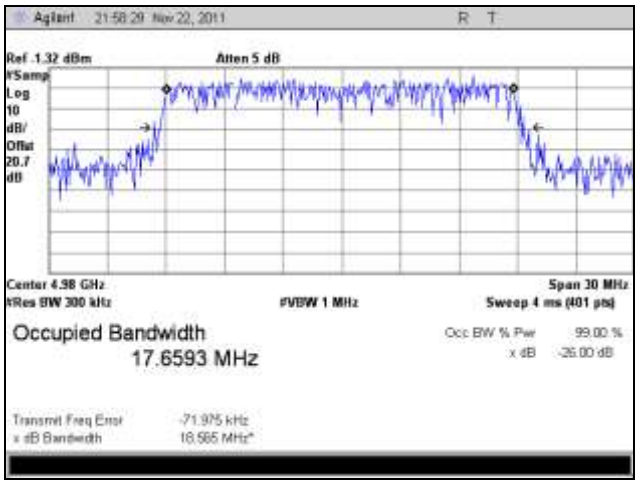


Plot 66. 99% Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port 2

99% Occupied Bandwidth, 802.11n 20 MHz, Port 3



Plot 67. 99% Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port 3



Plot 68. 99% Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port 3

5. Electromagnetic Compatibility Spurious Emissions at Antenna Terminal Requirements

5.1. Spurious Emissions at Antenna Terminals

Test Requirement(s): **§2.1051 and §90.210(M) with FCC 04-265**

Test Procedures: As required by 47 CFR 2.1051, *spurious emissions at antenna terminal measurements* were made at the RF output terminals using a Spectrum Analyzer.

A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected to a Spectrum Analyzer and a Power Meter to monitor the output power level. The Spectrum Analyzer was set to sweep 30 MHz and up to 10th harmonic of the fundamental or 40GHz whichever is the lesser. Measurements were made at the low, mid and high channels.

The Conducted Spurious Emissions *Limit* is obtained by the following:

§90.210.m.6
On any frequency removal from the assigned frequency between above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

Test Results: Equipment complies with Section 2.1051 and 90.210(M) with FCC 04-265. EUT emissions are below the limit of -25dBm.

Test Engineer(s): Lionel Gabrillo

Test Date(s): 12/23/11

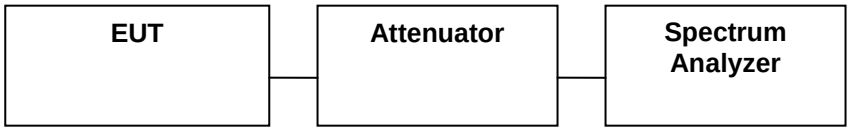
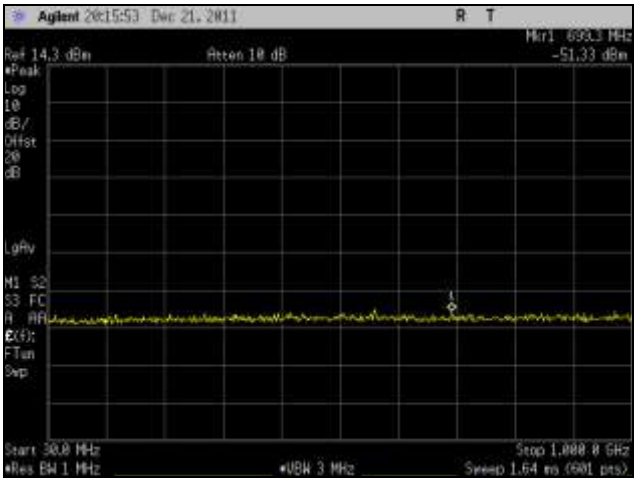
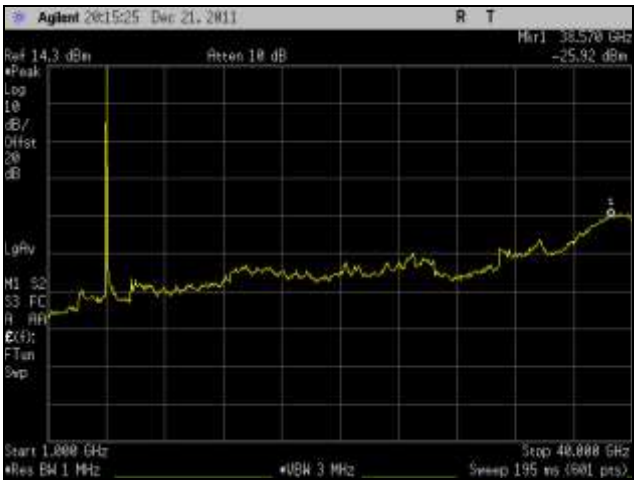


Figure 5. Spurious Emissions at Antenna Terminals Test Setup

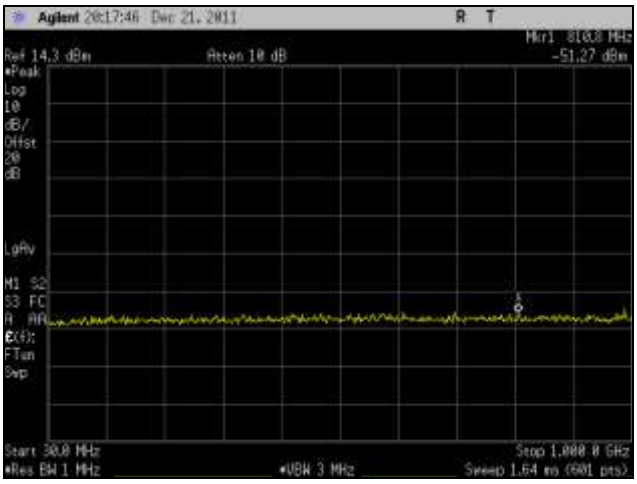
Conducted Spurious Emissions, 802.11a



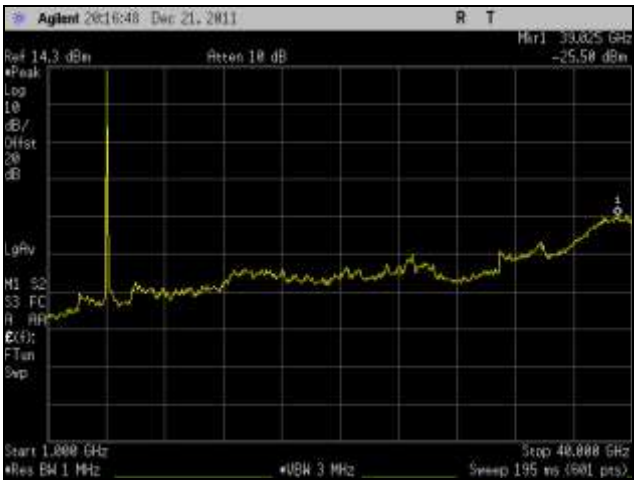
Plot 69. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 802.11a



Plot 70. Conducted Spurious Emissions, Low Channel, 1 GHz – 40 GHz, 802.11a

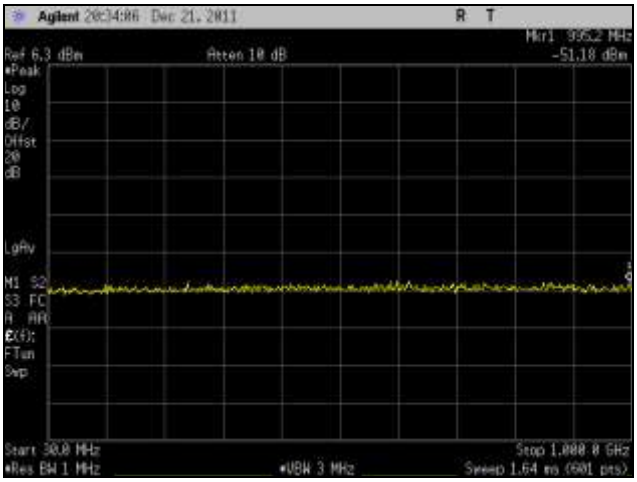


Plot 71. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz, 802.11a

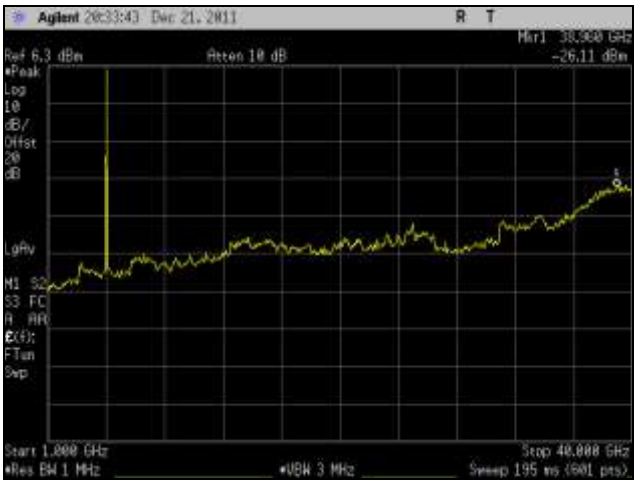


Plot 72. Conducted Spurious Emissions, High Channel, 1 GHz – 40 GHz, 802.11a

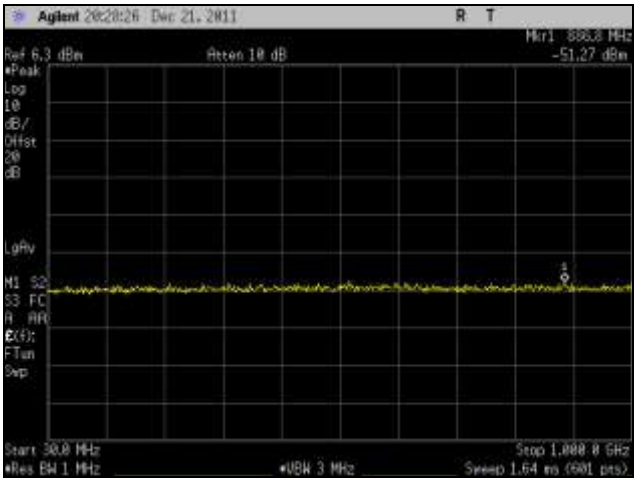
Conducted Spurious Emissions, 802.11n 10 MHz, Port 1



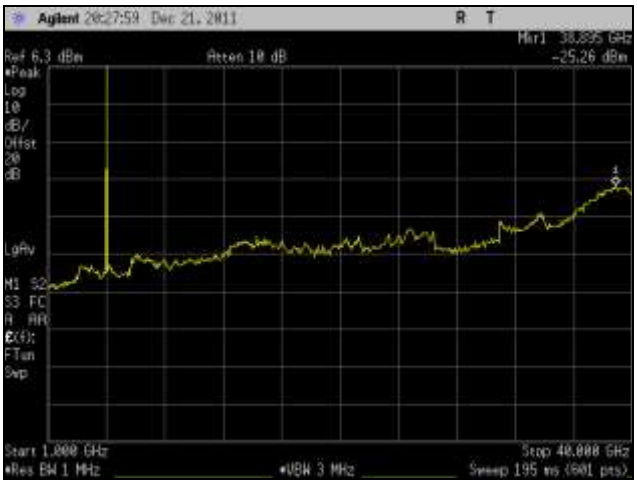
Plot 73. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 802.11n 10 MHz, Port 1



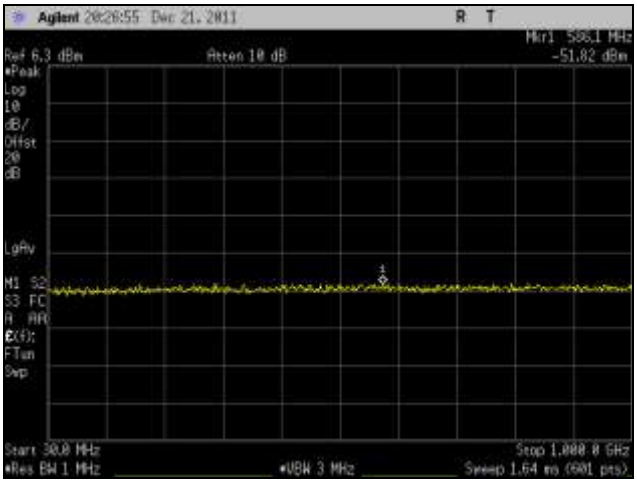
Plot 74. Conducted Spurious Emissions, Low Channel, 1 GHz – 40 GHz, 802.11n 10 MHz, Port 1



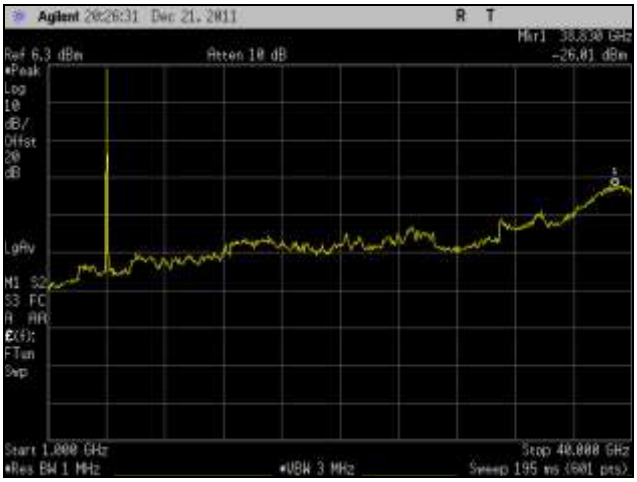
Plot 75. Conducted Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 802.11n 10 MHz, Port 1



Plot 76. Conducted Spurious Emissions, Mid Channel, 1 GHz – 40 GHz, 802.11n 10 MHz, Port 1

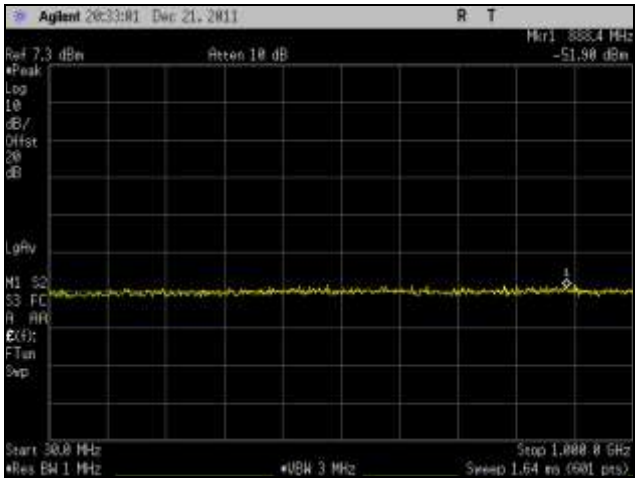


Plot 77. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz, 802.11n 10 MHz, Port 1

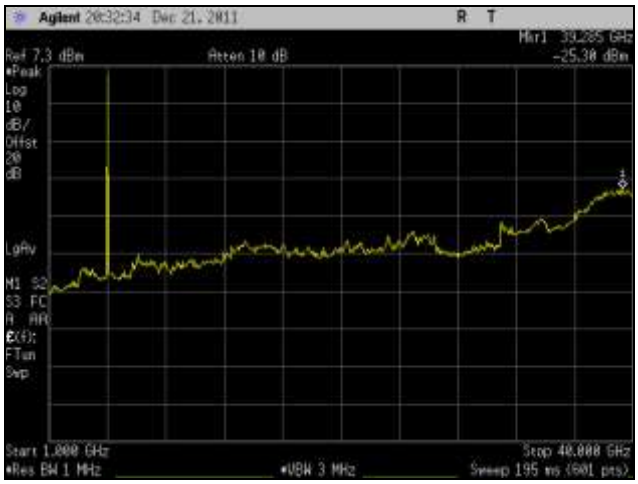


Plot 78. Conducted Spurious Emissions, High Channel, 1 GHz – 40 GHz, 802.11n 10 MHz, Port 1

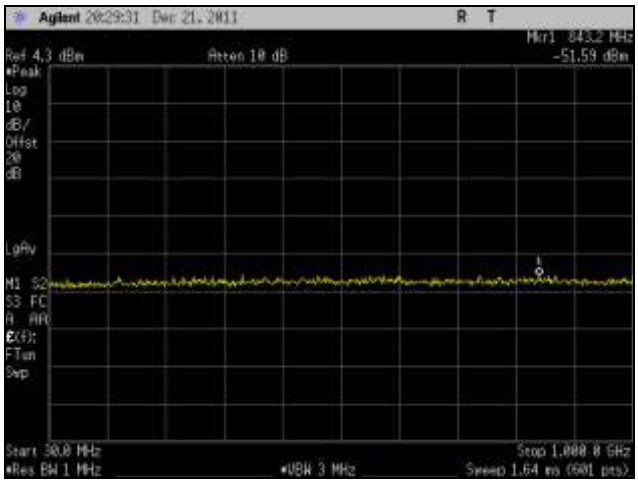
Conducted Spurious Emissions, 802.11n 10 MHz, Port 2



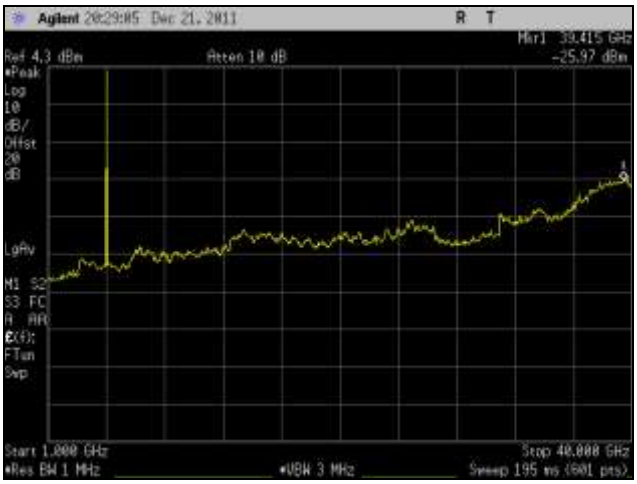
Plot 79. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 802.11n 10 MHz, Port 2



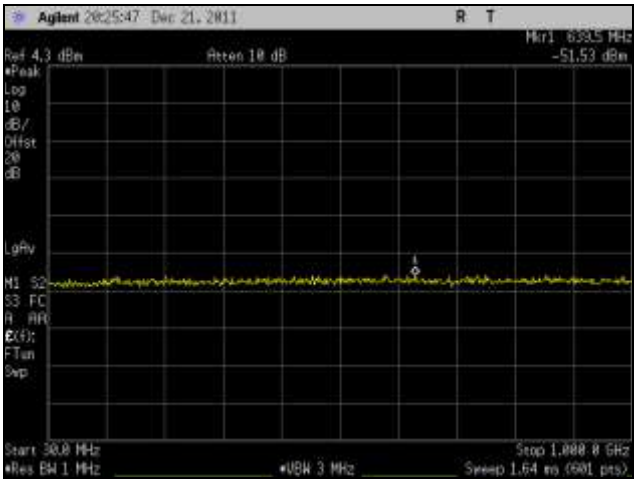
Plot 80. Conducted Spurious Emissions, Low Channel, 1 GHz – 40 GHz, 802.11n 10 MHz, Port 2



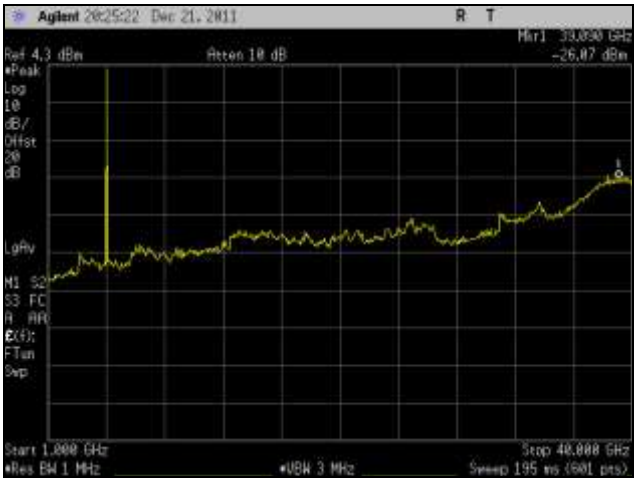
Plot 81. Conducted Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 802.11n 10 MHz, Port 2



Plot 82. Conducted Spurious Emissions, Mid Channel, 1 GHz – 40 GHz, 802.11n 10 MHz, Port 2

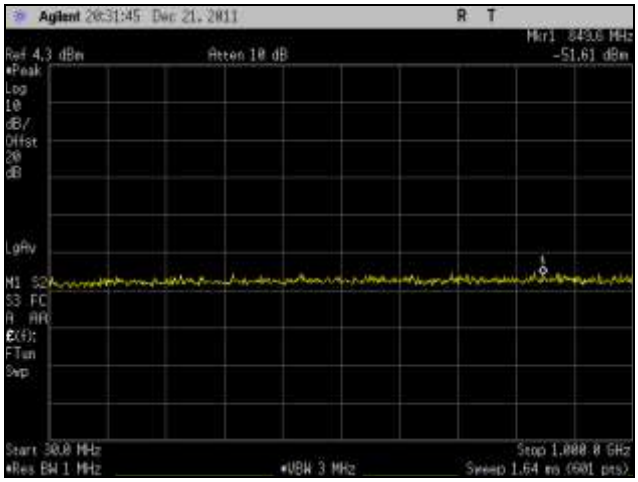


Plot 83. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz, 802.11n 10 MHz, Port 2

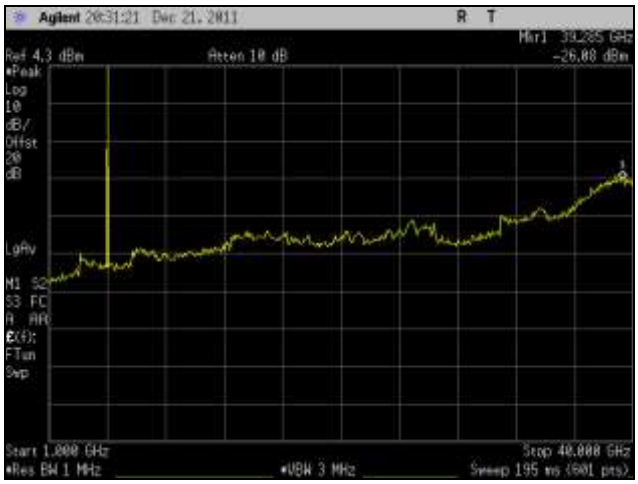


Plot 84. Conducted Spurious Emissions, High Channel, 1 GHz – 40 GHz, 802.11n 10 MHz, Port 2

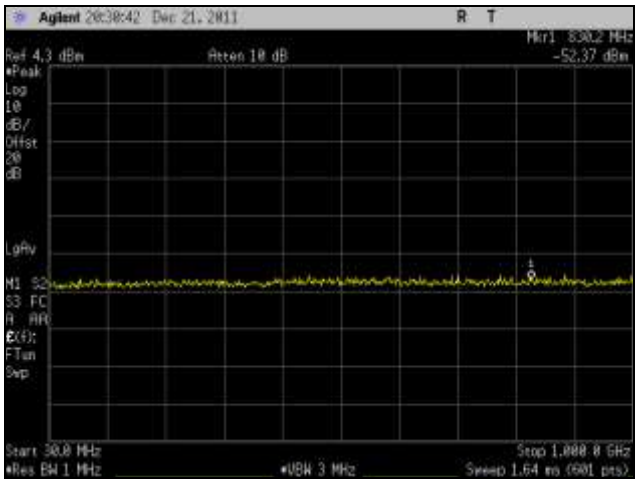
Conducted Spurious Emissions, 802.11n 10 MHz, Port 3



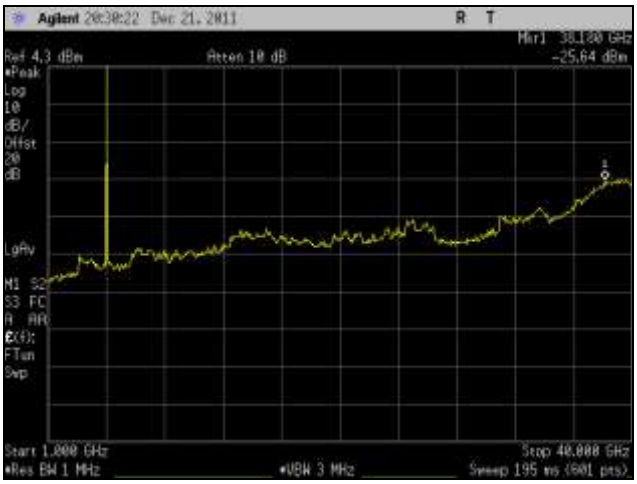
Plot 85. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 802.11n 10 MHz, Port 3



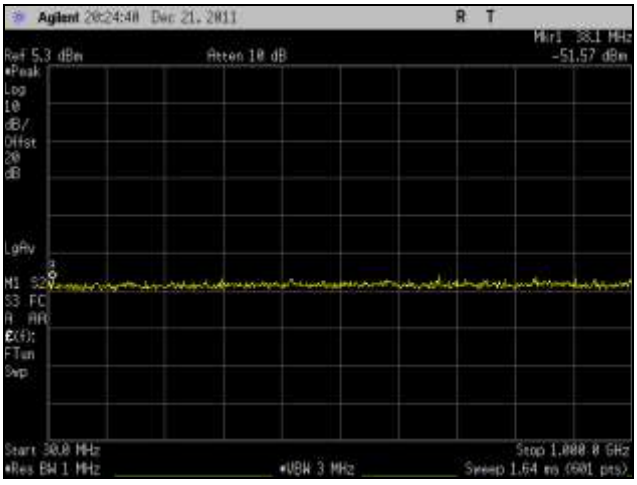
Plot 86. Conducted Spurious Emissions, Low Channel, 1 GHz – 40 GHz, 802.11n 10 MHz, Port 3



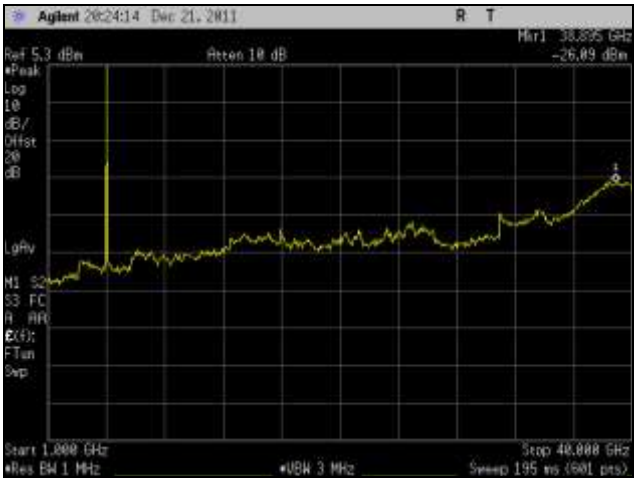
Plot 87. Conducted Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 802.11n 10 MHz, Port 3



Plot 88. Conducted Spurious Emissions, Mid Channel, 1 GHz – 40 GHz, 802.11n 10 MHz, Port 3

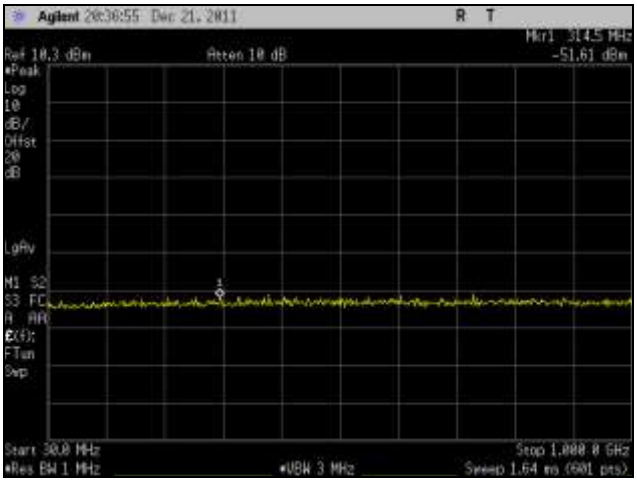


Plot 89. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz, 802.11n 10 MHz, Port 3

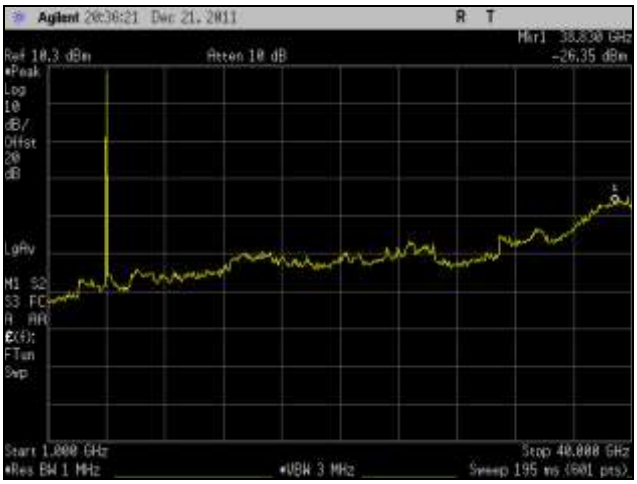


Plot 90. Conducted Spurious Emissions, High Channel, 1 GHz – 40 GHz, 802.11n 10 MHz, Port 3

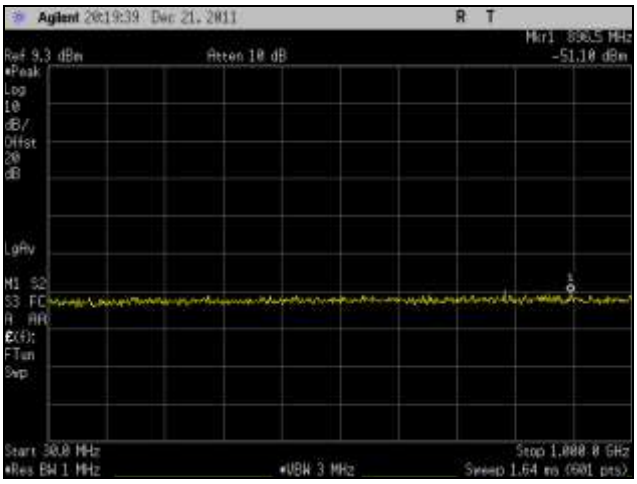
Conducted Spurious Emissions, 802.11n 20 MHz, Port 1



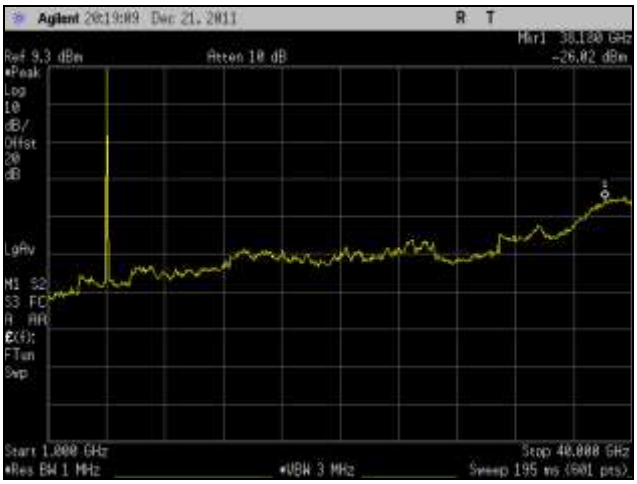
Plot 91. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 802.11n 20 MHz, Port 1



Plot 92. Conducted Spurious Emissions, Low Channel, 1 GHz – 40 GHz, 802.11n 20 MHz, Port 1

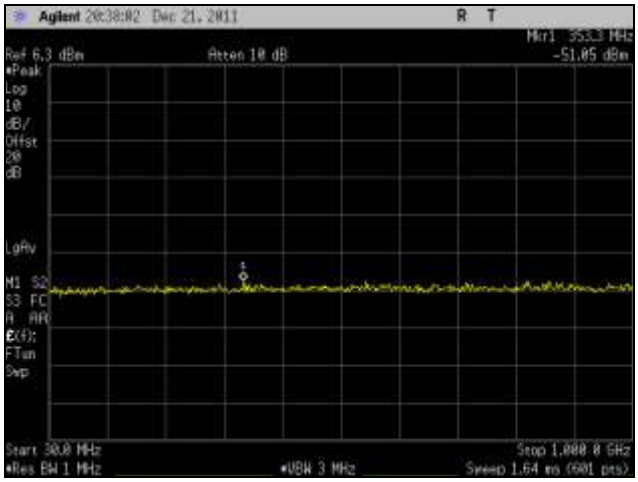


Plot 93. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz, 802.11n 20 MHz, Port 1

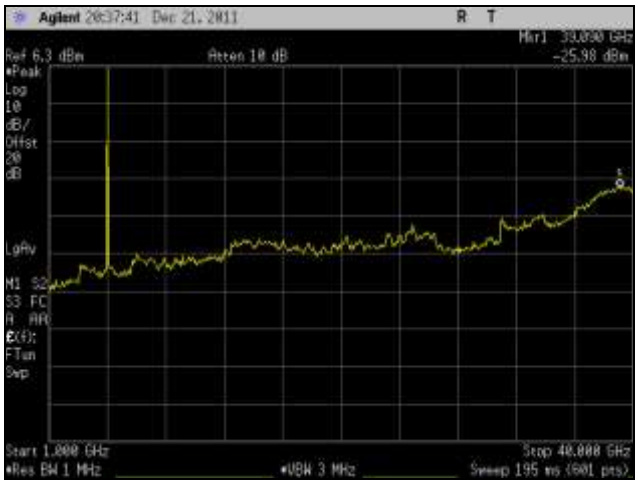


Plot 94. Conducted Spurious Emissions, High Channel, 1 GHz – 40 GHz, 802.11n 20 MHz, Port 1

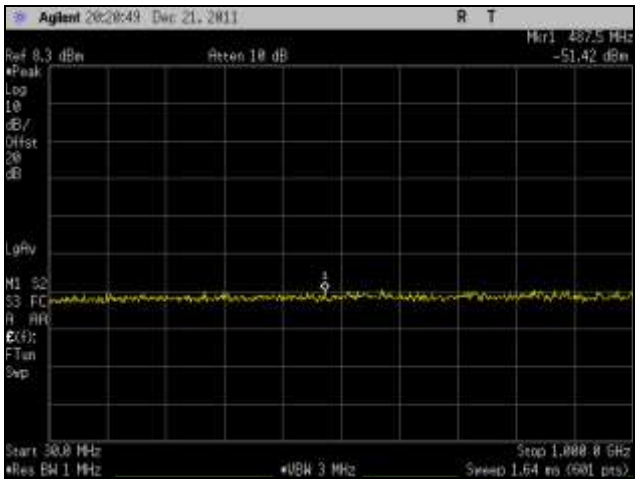
Conducted Spurious Emissions, 802.11n 20 MHz, Port 2



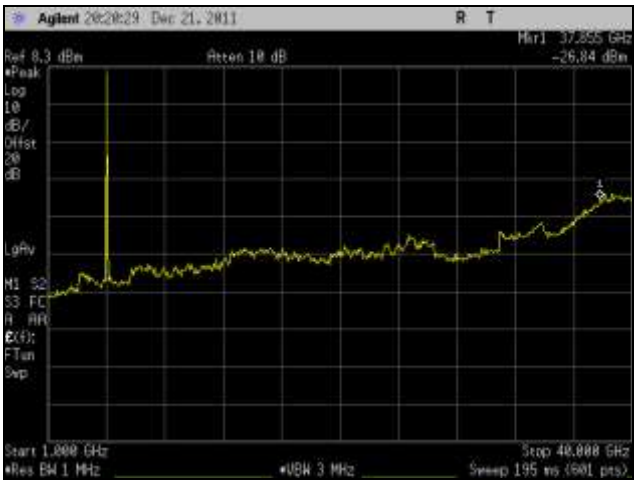
Plot 95. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 802.11n 20 MHz, Port 2



Plot 96. Conducted Spurious Emissions, Low Channel, 1 GHz – 40 GHz, 802.11n 20 MHz, Port 2

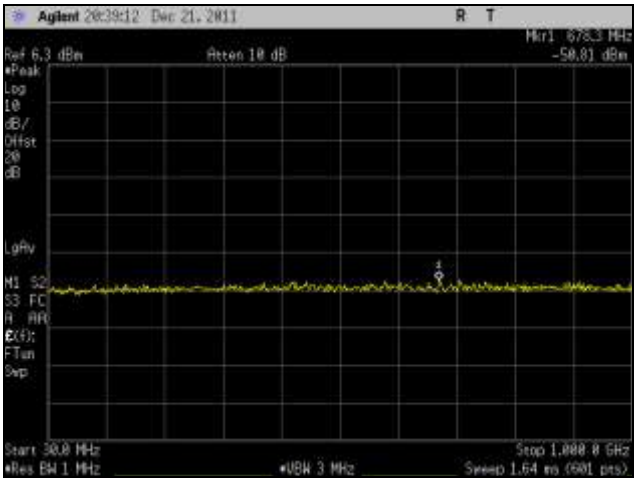


Plot 97. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz, 802.11n 20 MHz, Port 2

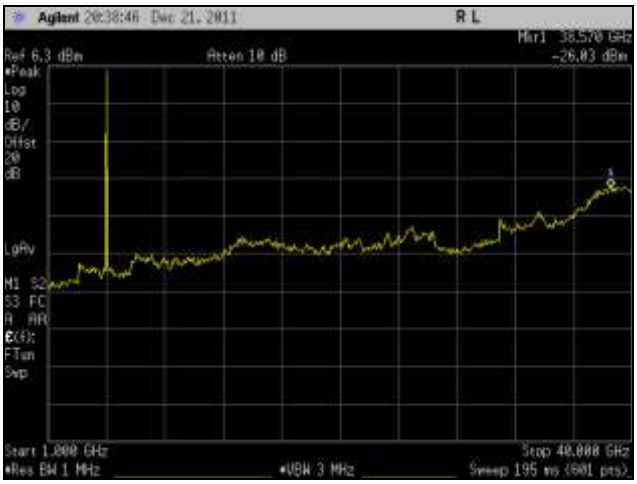


Plot 98. Conducted Spurious Emissions, High Channel, 1 GHz – 40 GHz, 802.11n 20 MHz, Port 2

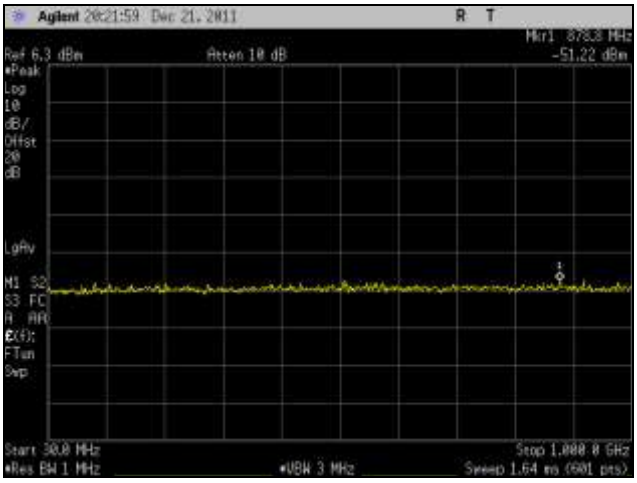
Conducted Spurious Emissions, 802.11n 20 MHz, Port 3



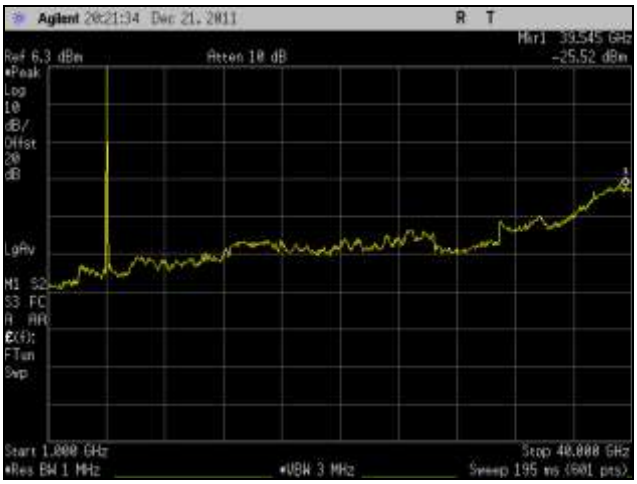
Plot 99. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 802.11n 20 MHz, Port 3



Plot 100. Conducted Spurious Emissions, Low Channel, 1 GHz – 40 GHz, 802.11n 20 MHz, Port 3



Plot 101. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz, 802.11n 20 MHz, Port 3



Plot 102. Conducted Spurious Emissions, High Channel, 1 GHz – 40 GHz, 802.11n 20 MHz, Port 3

Electromagnetic Compatibility Radiated Emissions Requirements

5.2. Radiated Emissions (Substitution Method)

Test Requirement(s): **§2.1053 and §90.210**

Test Procedures: As required by 47 CFR 2.1053, *field strength of radiated spurious measurements* were made in accordance with the procedures of TIA/EIA-603-A-2001 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards".

Radiated emission measurements were performed inside a 5 meter semi-anechoic chamber. The EUT was set at a distance of 3m from the receiving antenna. The EUT's RF ports were terminated to 50ohm load. The EUT was set to transmit at the low, mid and high channels of the transmitter frequency range at its maximum power level. The EUT was rotated about 360^0 and the receiving antenna scanned from 1-4m in order to capture the maximum emission. A calibrated antenna source was positioned in place of the EUT and the previously recorded signal was duplicated. The maximum EIRP of the emission was calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps were carried out with the receiving antenna in both vertical and horizontal polarization. Harmonic emissions up to the 10^{th} or 40GHz, which ever was the lesser, were investigated.

The test limit for this section was set to the same limit as for Section 6.1 of this report, or 50 dB attenuation to the peak emission of the fundamental.

No peaks were found above 18 GHz.

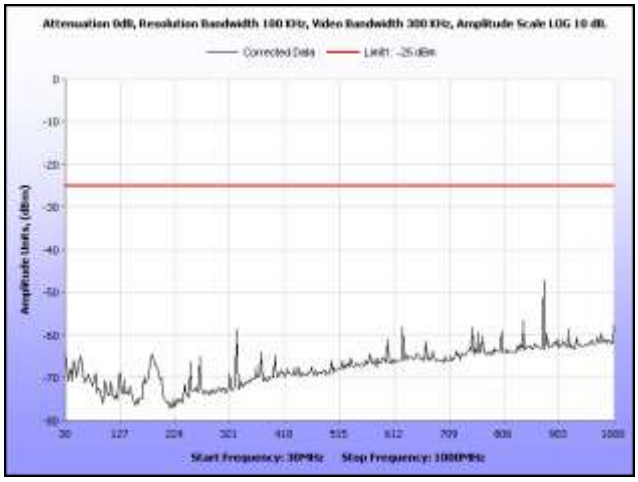
Note: Signal substitution was not performed due to the fact that only noise floor was detected from 30 MHz – 40 GHz.

Test Results: Equipment complies with Section 2.1053 and 90.210.

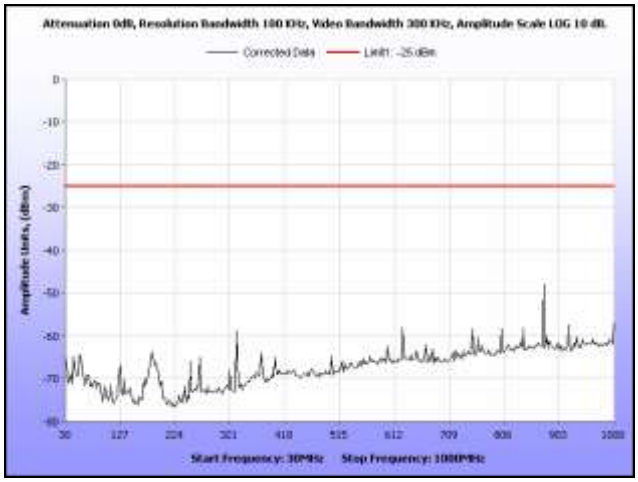
Test Engineer(s): Lionel Gabrillo

Test Date(s): 12/23/11

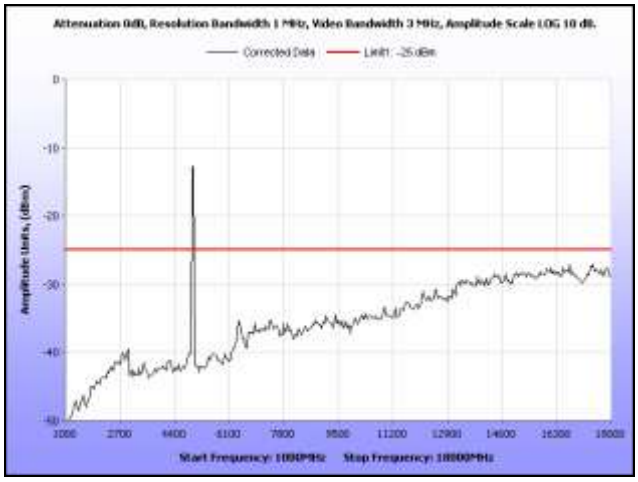
Radiated Spurious Emissions, 802.11a



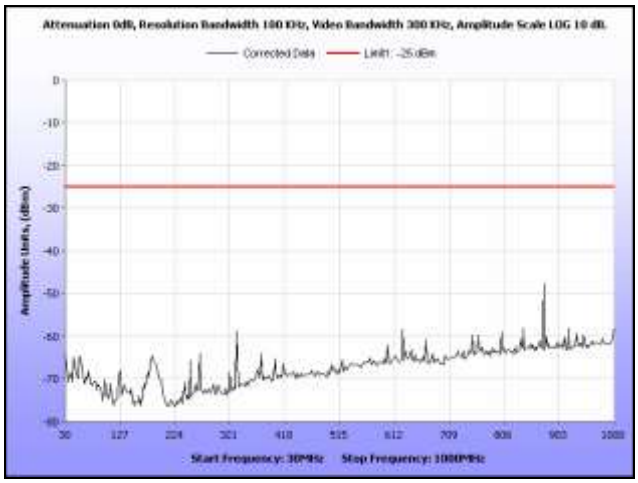
Plot 103. Radiated Spurious Emissions, Ambient with EUT ON and Radio OFF, 30 MHz – 1 GHz



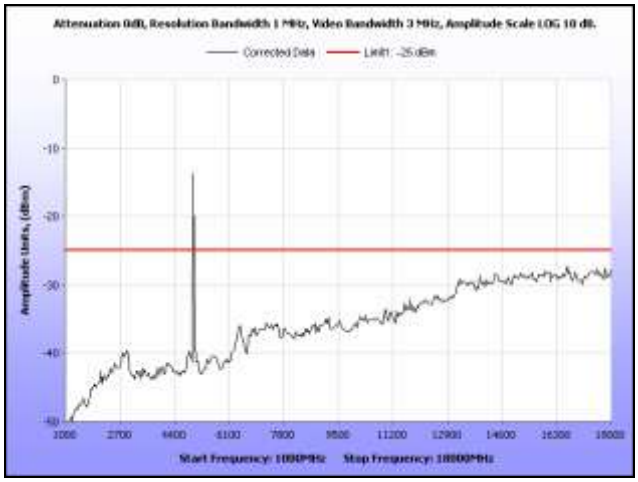
Plot 104. Radiated Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 802.11a



Plot 105. Radiated Spurious Emissions, Low Channel, 1 GHz – 18 GHz, 802.11a

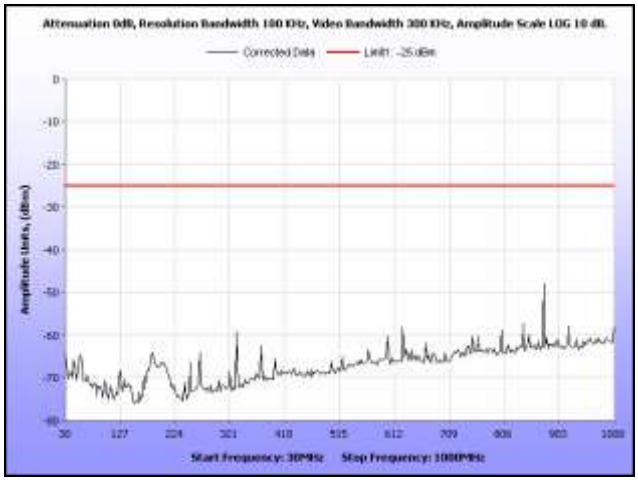


Plot 106. Radiated Spurious Emissions, High Channel, 30 MHz – 1 GHz, 802.11a

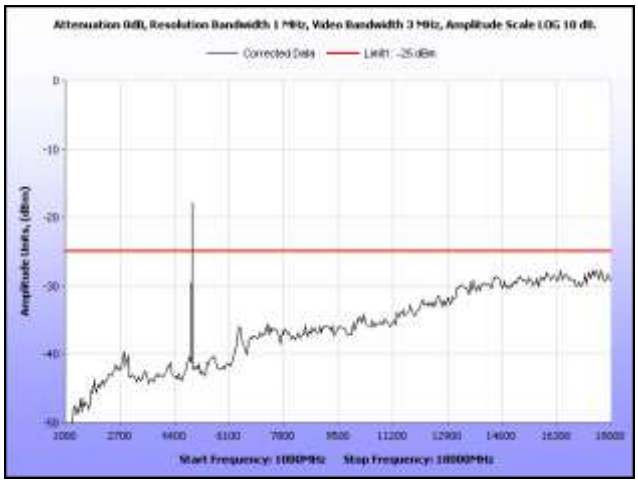


Plot 107. Radiated Spurious Emissions, High Channel, 1 GHz – 18 GHz, 802.11a

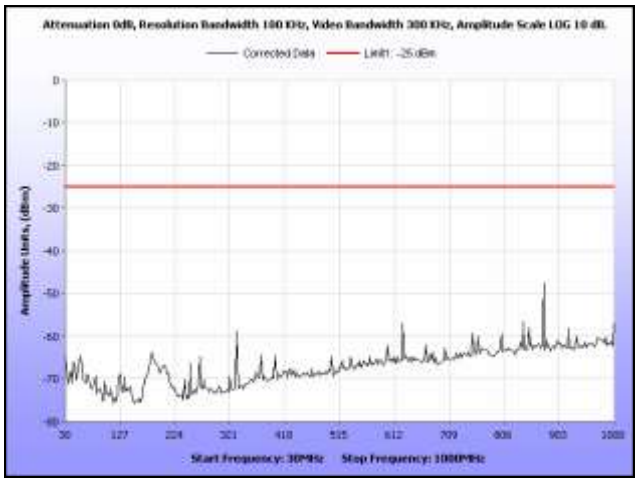
Radiated Spurious Emissions, 802.11n 10 MHz



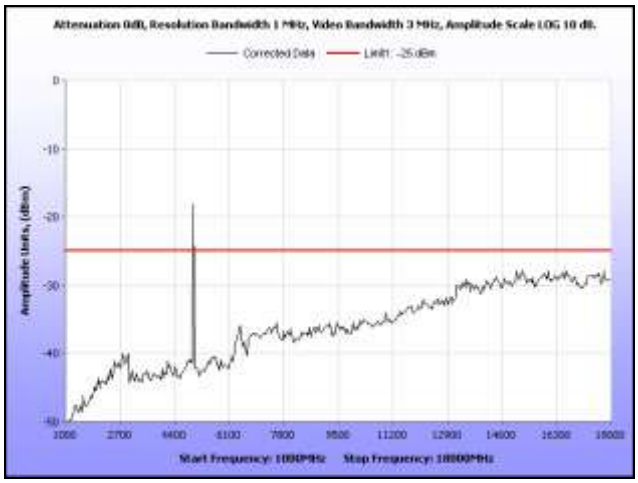
Plot 108. Radiated Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 802.11n 10 MHz



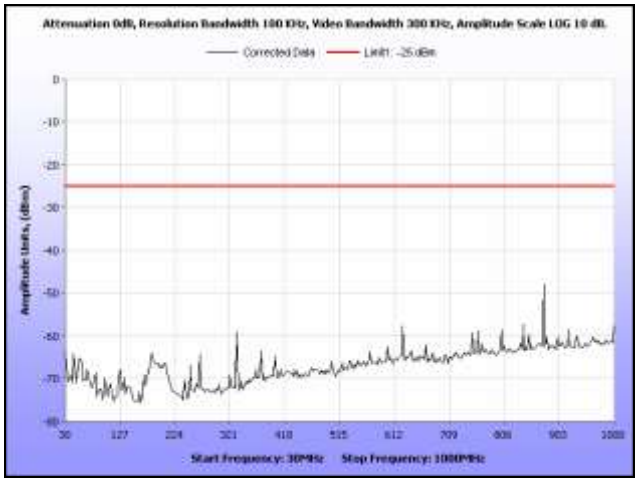
Plot 109. Radiated Spurious Emissions, Low Channel, 1 GHz – 18 GHz, 802.11n 10 MHz



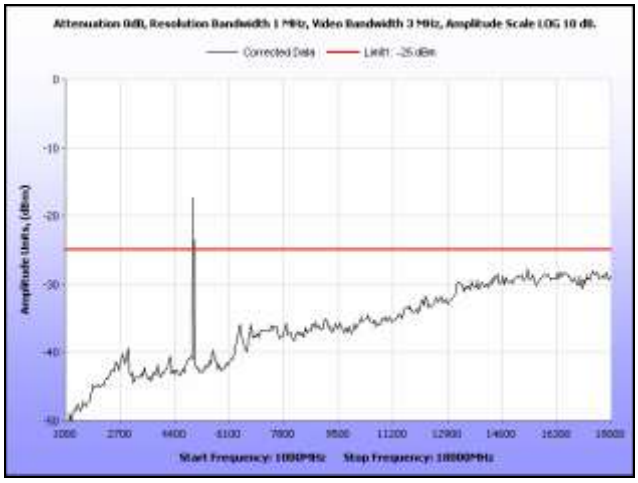
Plot 110. Radiated Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 802.11n 10 MHz



Plot 111. Radiated Spurious Emissions, Mid Channel, 1 GHz – 18 GHz, 802.11n 10 MHz

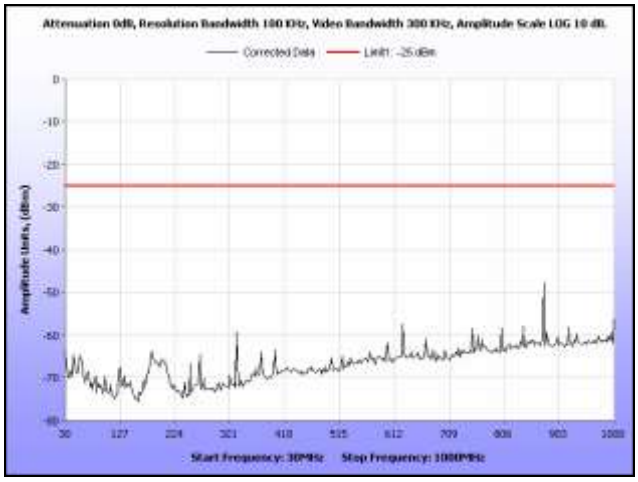


Plot 112. Radiated Spurious Emissions, High Channel, 30 MHz – 1 GHz, 802.11n 10 MHz

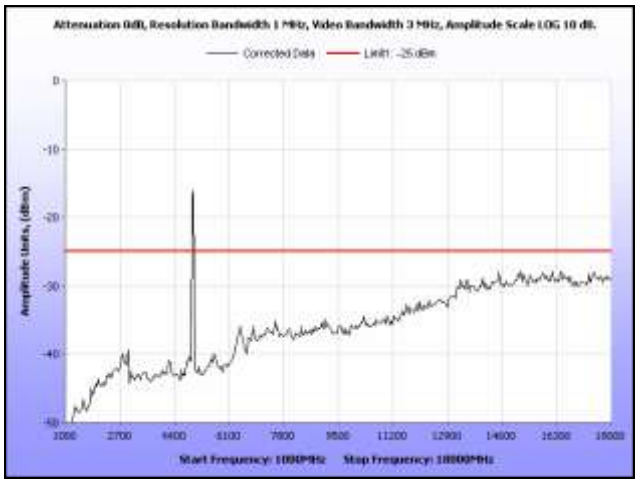


Plot 113. Radiated Spurious Emissions, High Channel, 1 GHz – 18 GHz, 802.11n 10 MHz

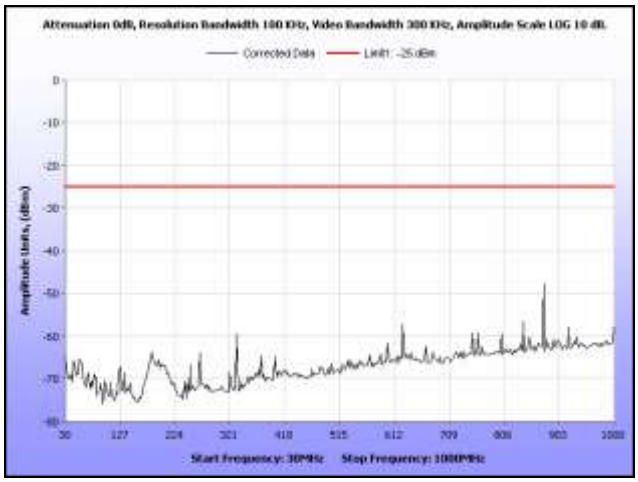
Radiated Spurious Emissions, 802.11n 20 MHz



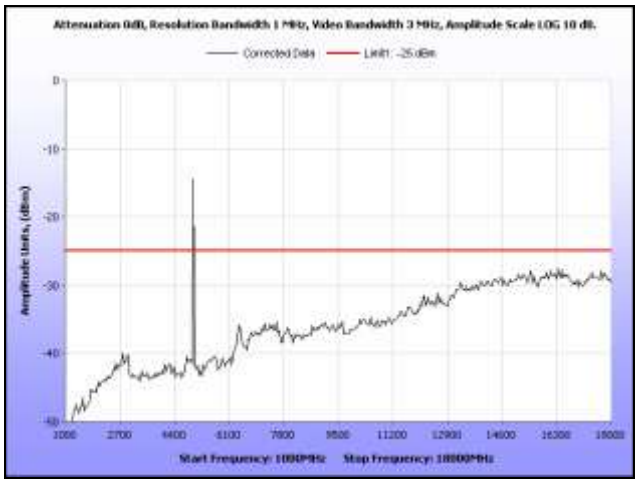
Plot 114. Radiated Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 802.11n 20 MHz



Plot 115. Radiated Spurious Emissions, Low Channel, 1 GHz – 18 GHz, 802.11n 20 MHz



Plot 116. Radiated Spurious Emissions, High Channel, 30 MHz – 1 GHz, 802.11n 20 MHz



Plot 117. Radiated Spurious Emissions, High Channel, 1 GHz – 18 GHz, 802.11n 20 MHz

Electromagnetic Compatibility Frequency Stability Requirements

5.3. Frequency Stability

Test Requirement(s): **§2.1055 and §90.213**

Test Procedures: As required by 47 CFR 2.1055, *Frequency Stability measurements* were made at the RF output terminals using a Directional Coupler through a Spectrum Analyzer and Power Meter.

The EUT was placed in the Environmental Chamber and support equipments are outside the chamber on a table. The EUT was set to transmit a CW signal corresponding to the low, mid and high Channels for 5, 10, & 20MHz Bandwidths. The frequency counter option on the Spectrum Analyzer was used to measure frequency deviations. The frequency drift was investigated for every 10^{C} increment until the unit is stabilized then recorded the reading in tabular format with the temperature range of -30 to 50^{C}.

Voltage supplied to EUT is 120 VAC reference temperature was done at 20 ^{C}. The voltage was varied by ± 15 % of nominal

Test Results: Equipment complies with Section 2.1055 and 90.213

Test Engineer(s): Lionel Gabrillo

Test Date(s): 12/23/11

Frequency Stability Test Results

(Low Channel)				
	Voltage (AC)	**Temperature (C)**	**Frequency (MHz)**	**PPM**
Reference	120	60	4945.038941	5.375
	120	50	4945.024901	2.536
	120	40	4945.046170	6.837
	120	30	4945.068211	11.294
	120	20	4945.012360	0.000
	120	10	4945.010231	0.431
4945.012360	120	0	4945.018620	1.266
	120	-10	4944.987320	5.064
	120	-20	4944.984123	5.710
	120	-30	4944.975512	7.452
	120	-40	4944.971291	8.305
	102	20	4944.988100	4.906
	138	20	4944.972110	8.140
(Mid Channel)				
	Voltage (AC)	**Temperature (C)**	**Frequency (MHz)**	**PPM**
Reference	120	60	4965.042310	15.143
	120	50	4965.053210	17.338
	120	40	4965.051475	16.989
	120	30	4965.023121	11.278
	120	20	4964.967126	0.000
	120	10	4965.045891	15.864
4964.967126	120	0	4965.014711	9.584
	120	-10	4964.994720	5.558
	120	-20	4964.985396	3.680
	120	-30	4964.976172	1.822
	120	-40	4964.975663	1.719
	102	20	4964.961280	1.177
	138	20	4964.966620	0.102
(High Channel)				
	Voltage (AC)	**Temperature (C)**	**Frequency (MHz)**	**PPM**
Reference	120	60	4985.026570	7.212
	120	50	4985.076523	2.809
	120	40	4985.037512	5.017
	120	30	4985.025259	7.475
	120	20	4985.062521	0.000
	120	10	4985.054710	1.567
4985.062521	120	0	4985.029129	6.698
	120	-10	4984.996512	13.241
	120	-20	4984.984510	15.649
	120	-30	4984.978230	16.909
	120	-40	4984.996841	13.175
	102	20	4985.036547	5.210
	138	20	4985.048293	2.854

Table 6. Frequency Stability, Test Results, 802.11n 10 MHz

(Low Channel)				
	Voltage (AC)	**Temperature (C)**	**Frequency (MHz)**	**PPM**
Reference	120	60	4950.111280	9.689
	120	50	4950.039401	4.832
	120	40	4950.061240	0.420
	120	30	4950.123329	12.123
	120	20	4950.063321	0.000
	120	10	4950.057763	1.123
4950.063321	120	0	4950.011512	10.466
	120	-10	4949.996131	13.574
	120	-20	4949.982899	16.247
	120	-30	4949.994290	13.945
	120	-40	4949.978791	17.077
	102	20	4950.041722	4.363
	138	20	4950.059040	0.865
(High Channel)				
	Voltage (AC)	**Temperature (C)**	**Frequency (MHz)**	**PPM**
Reference	120	60	4980.119612	17.745
	120	50	4980.089310	11.660
	120	40	4980.022780	1.699
	120	30	4980.025891	1.074
	120	20	4980.031242	0.000
	120	10	4980.043087	2.378
4980.031242	120	0	4980.010833	4.098
	120	-10	4979.997712	6.733
	120	-20	4979.961210	14.063
	120	-30	4979.977861	10.719
	120	-40	4979.978883	10.514
	102	20	4980.031820	0.116
	138	20	4980.048616	3.489

Table 7. Frequency Stability, Test Results, 802.11n 20 MHz

6. RF Exposure Requirements

RF Exposure Requirements: **§90.1217, §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 @ 4945-4985 MHz; highest conducted power = 26.578 dBm (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

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

EUT with 9 dBi Omni Antenna

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

where, S = Power Density (1 mW/cm^2)
P = Power Input to antenna (454.78 mW)
G = Antenna Gain (7.94 numeric)
R = Minimum Distance between User and Antenna (20 cm)

$S = (454.78 * 7.94)/(4 * 3.14 * 20^2) = 3610.95/5024 = 0.719$ mW/cm^2

Since S < 1 mW/cm^2, the minimum distance (R) is 20cm

EUT with 15 dBi Sector Antenna

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

where, S = Power Density (1 mW/cm^2)
P = Power Input to antenna (454.78 mW)
G = Antenna Gain (31.62 numeric)
R = Minimum Distance between User and Antenna (20 cm)

$S = (454.78 * 31.62)/(4 * 3.14 * 20^2) = 14380.14/5024 = 2.862$ mW/cm^2

Since S > 1 mW/cm^2, the minimum distance (R) should be

$R = (454.78 * 31.62/4 * 3.14)^{1/2} = (14380.14/12.56)^{1/2} = 33.84$cm in order to comply with 1 mW/cm^2

EUT with 16 dBi Panel Antenna

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

where, S = Power Density (1 mW/cm^2)
P = Power Input to antenna (454.78 mW)
G = Antenna Gain (39.81 numeric)
R = Minimum Distance between User and Antenna (20 cm)

$S = (454.78 * 39.81)/(4*3.14*20^2) = 18104.79/5024 = 3.604\ mW/cm^2$

Since $S > 1\ mW/cm^2$, the minimum distance (R) should be

$R = (454.78 * 39.81/4*3.14)^{1/2} = (18104.79/12.56)^{1/2} = 37.97cm$ in order to comply with 1 mW/cm^2

7. Electromagnetic Compatibility Receiver Spurious Requirements

7.1. Receiver Spurious Emissions

Test Requirement: The following receiver spurious emission limits shall be complied with:

a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 8.

Spurious Frequency (MHz)	Field Strength (microvolt/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960	500

Table 8. Spurious Emission Limits for Receivers

b) If a conducted measurement is made, no spurious output signals appearing at the antenna terminals shall exceed 2 nanowatts per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5 nanowatts above 1 GHz.

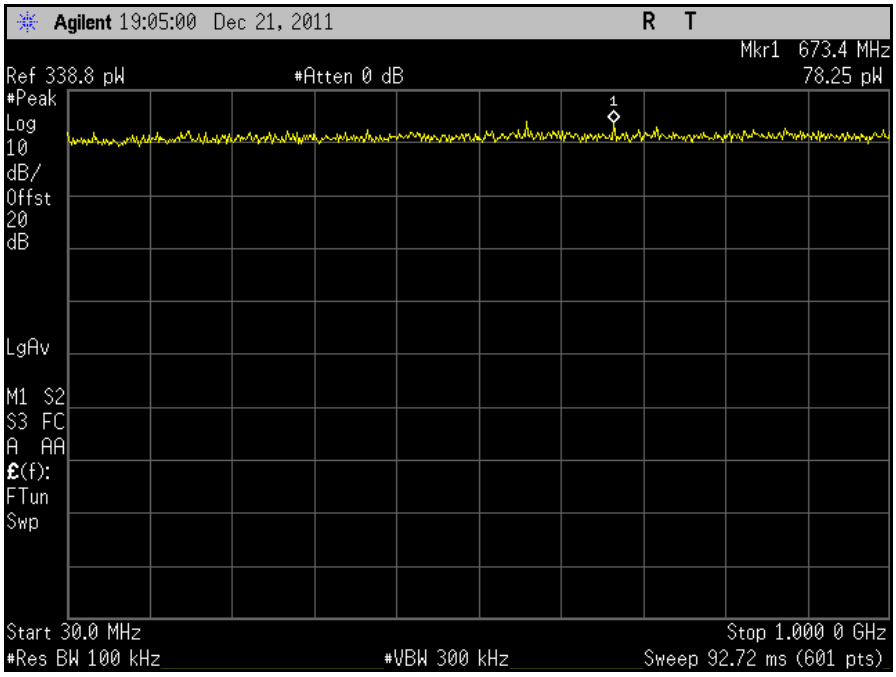
Test Procedure: The receiver spurious emissions were tested in compliance with the limits of Table 12. The testing was performed conducted.

Test Results: The EUT was compliant with the Receiver Spurious Emission limits of this requirement.

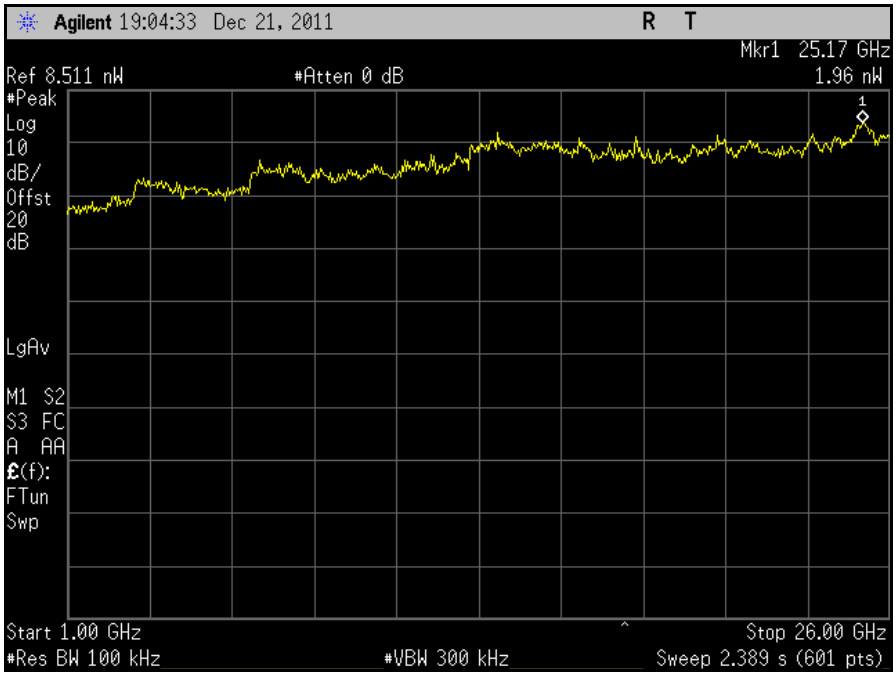
Test Engineer(s): Lionel Gabrillo

Test Date(s): 12/23/11

Receiver Spurious Emissions



Plot 118. Conducted Receiver Spurious Emissions, 30 MHz – 1 GHz



Plot 119. Conducted Receiver Spurious Emissions, 1 GHz – 26 GHz

8. Electromagnetic Compatibility Peak Excursion Requirements

8.1. Peak Excursion

Test Requirement: **§90.1215(e)**
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

Test Procedure: The EUT was connected directly to the spectrum analyzer through cabling and attenuation. The 1st trace on the spectrum analyzer was set to RBW=1MHz, VBW=3MHz. The peak detector mode was used and the trace max held. The 2nd trace on the spectrum analyzer was set according to measurement method #1 from the FCC Public Notice DA 02-2138 for making conducted power measurements.

Test Results: The EUT was compliant with the peak excursion limits of this requirement.

Test Engineer(s): Lionel Gabrillo

Test Date(s): 02/09/12

Mode	Carrier Channel	Frequency (MHz)	Peak Conducted Output Power	Peak Power Spectral Density	Peak Excursion Ratio	Limit (dBm)
802.11a	Low	4950	22.880	13.770	9.110	13.00
	High	4980	22.310	13.830	8.480	13.00
802.11n 10 MHz	Low	4945	26.578	20.554	6.024	13.00
	Mid	4965	25.859	20.796	5.063	13.00
	High	4985	26.460	20.690	5.770	13.00
802.11n 20 MHz	Low	4950	22.891	13.490	9.401	13.00
	High	4980	23.390	13.538	9.852	13.00

9. 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
1S2607	SPECTRUM ANALYZER	AGILENT/HP	E4407B	8/9/2011	8/9/2012
1S2691	DUAL-LINE V-LISN	TESEQ	NNB-51	3/31/2011	3/31/2012
1S2633	TRANSIENT LIMITER	FISCHER CUSTOM COMMUNICATIONS INC.	FCC-450B-2.4-N	2/18/2011	2/18/2012
1S2399	TURNTABLE CONTROLLER	SUNOL SCIENCE	SC99V	NO CALIBRATION REQUIRED	
1S2501	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU40	06/09/2011	06/09/2012
1S2482	5 METER CHAMBER	PANASHIELD	641431	11/18/2011	11/18/2012
1S2460	SPECTRUM ANALYZER	AGILENT	E4407B	7/12/2011	7/12/2012
1S2583	SPECTRUM ANALYZER	AGILENT/HP	E4447A	3/18/2011	3/18/2012
1S2600	BILOG ANTENNA	TESEQ	CBL6112D	4/14/2010	4/14/2013
1S2501	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU40	06/09/2011	06/09/2012
1S2198	HORN ANTENNA	EMCO	3115	9/29/2011	9/29/2012
N/A	HIGH PASS FILTER	MICRO-TRONICS	HPM13147	SEE NOTE	
1S2714	THERM/CLOCK/HUMIDITY MONITOR	CONTROL COMPANY	06-662-4, FB7025B	11/9/2011	11/9/2013
1S2523	PREAMP (1-26.5GHZ)	AGILENT	8449B	SEE NOTE	
1S2229	TEMPERATURE CHAMBER	TENNY ENGINEERING	T63C	2/18/2011	2/18/2012
1S2202	HORN ANTENNA (18GHZ – 26GHZ)	EMCO	3116	4/23/2010	4/23/2013
1S2698	DOUBLE RIDGE GUIDE HORN ANTENNA (26GHZ – 40GHZ)	A.H. SYSTEMS, INC.	SAS-574	5/24/2011	5/24/2012

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

Certification & User's Manual Information

10. Certification Label & User's Manual Information

10.1. 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 provision that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart Y — 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.[1] *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, whichever is applicable.

§ 2.902 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.

[1] 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.

§ 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.

10.2. 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.

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 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.

End of Report

