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 8, 2011

Firetide
140 Knowles Drive
Los Gatos, CA 95032

Dear Bharath Channakeshava,

Enclosed is the EMC test report for compliance testing of the Firetide, HotPoint 4100 and FWB-102, tested to the requirements of Title 47 of the Code of Federal Regulations (CFR), Part 90 Subpart Y 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\EMCS81960A-FCC90 Rev. 1)

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Electromagnetic Compatibility Criteria Test Report

For the

Firetide
HotPoint 4100 and FWB-102

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: EMCS81960A-FCC90 Rev. 1

February 8, 2011

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

Prepared By:
MET Laboratories, Inc.
3162 Belick Street,
Santa Clara, CA 95054

Electromagnetic Compatibility Criteria
Test Report

For the

Firetide
HotPoint 4100 and FWB-102

Tested under

The FCC Verification Rules
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for Private Land Mobile Radio Services
and
RSS-111, Issue 3, June 2009

MET Report: EMCS81960A-FCC90 Rev. 1

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 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 Coordinator, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	February 17, 2010	Initial Issue.
1	February 8, 2011	Revised to reflect engineer corrections and to add additional model.

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 Plots

List of Figures

List of Photographs

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
Hz	**H**ert**z**
kHz	**k**ilo**h**ert**z**
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µ	**microf**arad
µs	**micros**econds
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
V/m	**V**olts **per m**eter

I. Testing Summary

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.

II. Equipment Configuration

2.1 Overview

MET Laboratories, Inc. was contracted by Firetide. to perform testing on the HotPoint 4100 and FWB-102 under Firetide purchase order number 2532.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Firetide, HotPoint 4100 and FWB-102.

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. 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:	HotPoint 4100	
Model(s) Covered:	HotPoint 4100 and FWB-102	
EUT Specifications:	115VAC	
	FCC ID: REP-4100-1 IC: 4988A-4100	
	Emission Designators:	
	Max Peak and Average Output Power:	**5MHz:** 19.84dBm **10MHz:** 19.88dBm **20MHz:** 19.30dBm
	Equipment Code:	TNB
	EUT Frequency Ranges:	4945-4985MHz 4950-4980MHz
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:	Minh Ly	
Date(s):	February 8, 2011	

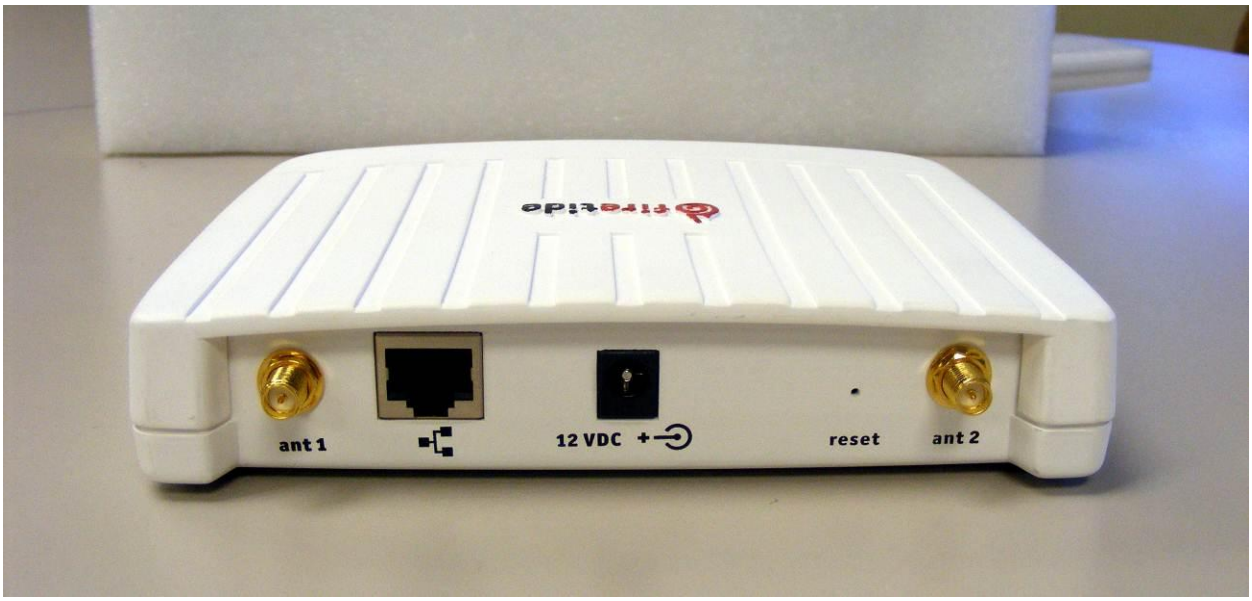
2.2 Test Site

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. In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories. In accordance with §2.948(d), MET Laboratories has been accredited by the National Voluntary Laboratory Accreditation Program (Lab Code: 100273-0).

2.3 Description of Test Sample

The Firetide HotPoint 4100 and FWB-102, Equipment Under Test (EUT), is an Indoor Wireless Access Point (802.11 a/g modes) with diversity (I.E Two antenna ports)



Photograph 1. Firetide, HotPoint 4100 and FWB-102

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.

Name / Description	Model Number	Serial Number
Hot Client 4100 AP	4100	M12150705000591
AC/DC Power Supply (PHIHONG)	PSA-18R-12oP	N/A

Table 1. Equipment Configuration

2.5 Support Equipment

Firetide supplied support equipment necessary for the operation and testing of the HotPoint 4100 and FWB-102. All support equipment supplied is listed in the following Support Equipment List.

Ref. ID	Name / Description	Manufacturer	Model Number	Serial Number
C	Laptop	DELL	D500	CN-044212-48643
	2.4GHz Dipole	Wha Yu	C812-510010	N/A
	4.9 -5.8GHz Dipole	Wha Yu	C812-510012	N/A

Table 2. 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.

2.6 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 ID
1	Ethernet	RJ45	1	3	No	C
2	DC PWR	PWR Cord From AC/DC Brick	1	1	No	B

Table 3. Ports and Cabling Information

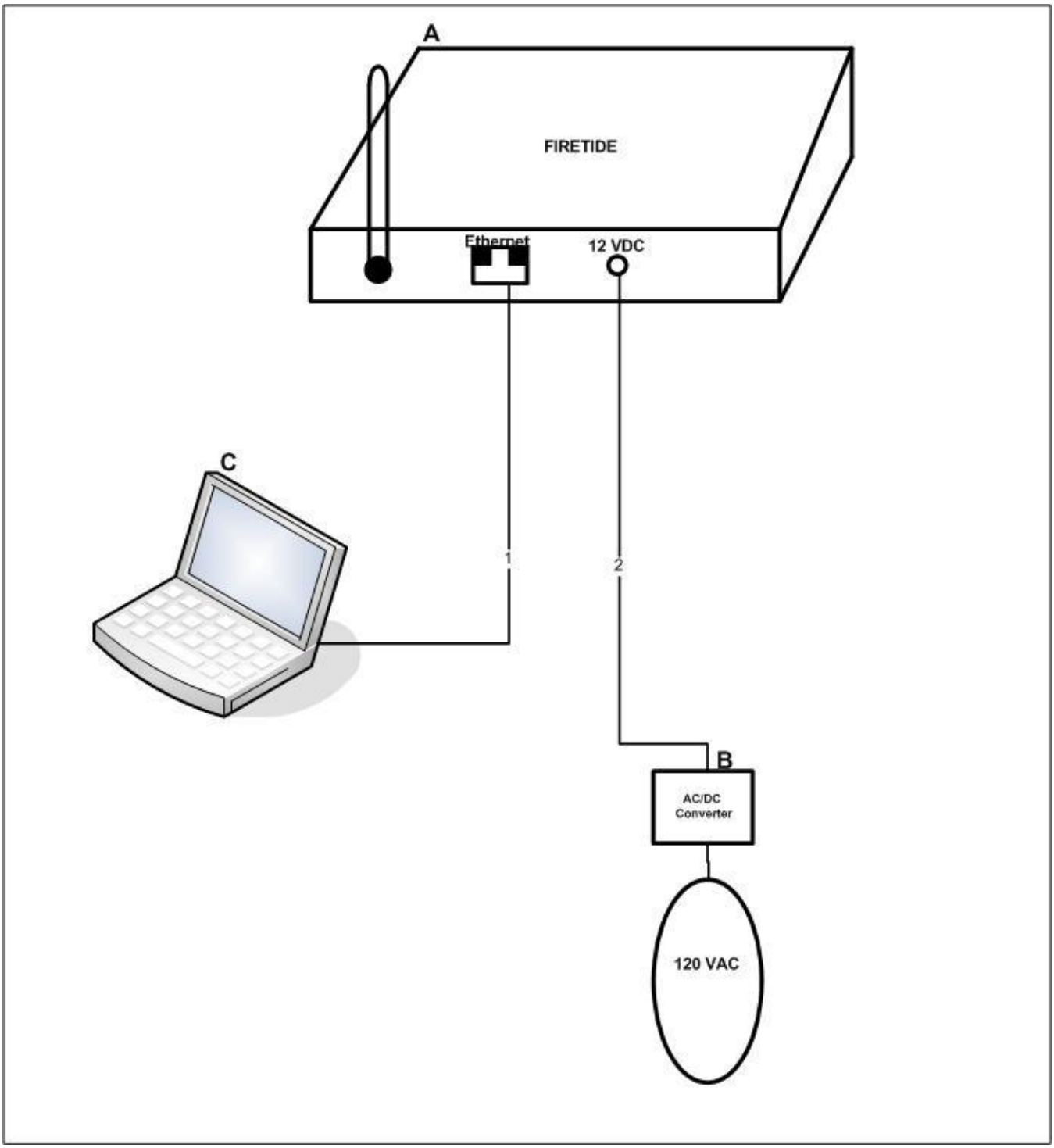


Figure 1. Block Diagram of Test Configuration

2.7 Mode of Operation

EUT is controlled via a laptop computer. EUT has atheros ART firmware loaded.

2.8 Method of Monitoring EUT Operation

IP Connectivity. EUT has a fixed IP address of 192.168.1.20

2.9 Modifications

a.) **Modifications to EUT**

Added 0.47 uF at C29 to fix 30M to 300MHz range. Added 33 pF at C9 and C18 to fix 500M and 541MHz

b.) **Modifications to Test Standard**

No modifications were made to the EUT.

2.10 Disposition of EUT

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

III. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility RF Power Output Requirements

§2.1046 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 to monitor the Peak and Average power. The EUT power was adjusted enough to produce maximum output power as to meet the requirements of this rule part. The output power was then recorded with peak and average reading.

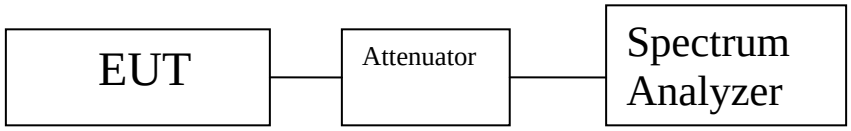
Test Results: The EUT is compliant with 47CFR 2.1046 and 90.1215(a) with FCC 04-265.

RF Power Output	
Frequency (MHz)	**Peak Power (dBm)**
5 MHz	
4945.0	19.84
4965.0	19.55
4985.0	19.45
10 MHz	
4945.0	19.88
4965.0	19.72
4985.0	19.70
20MHz	
4950.0	19.30
4980.0	19.05

Table 4. RF Output Power Test Results

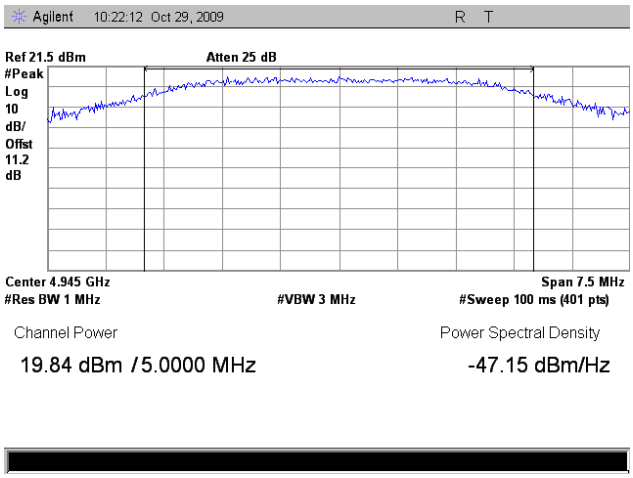
Test Engineer(s): Minh Ly

Test Date(s): October 29, 2009

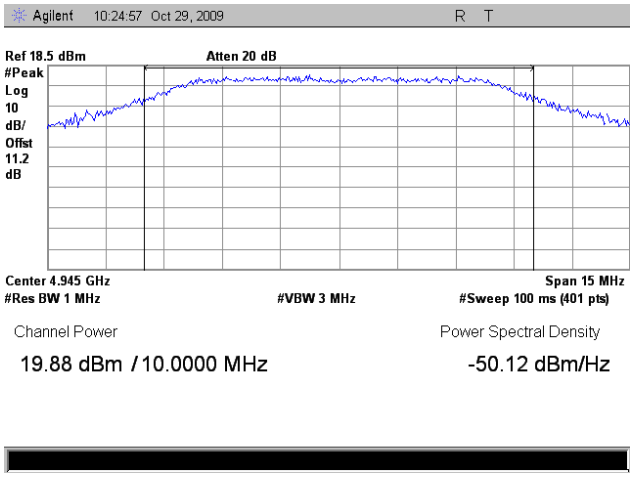


Block Diagram 1. Peak Power Output Test Setup

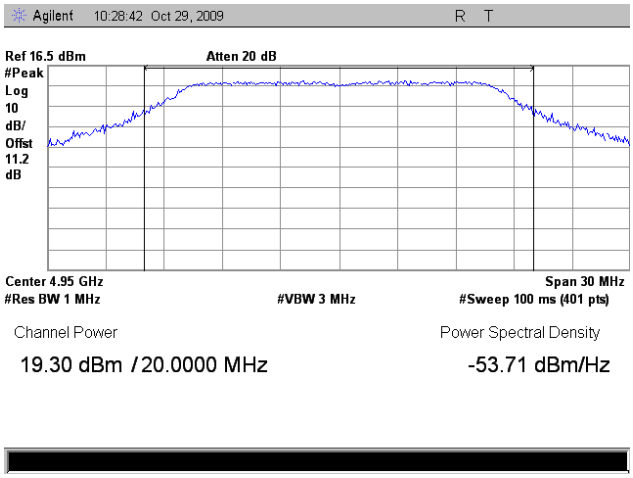
RF Power Output Power Test Results



Plot 1. Low Channel RF Output Power, 5MHz

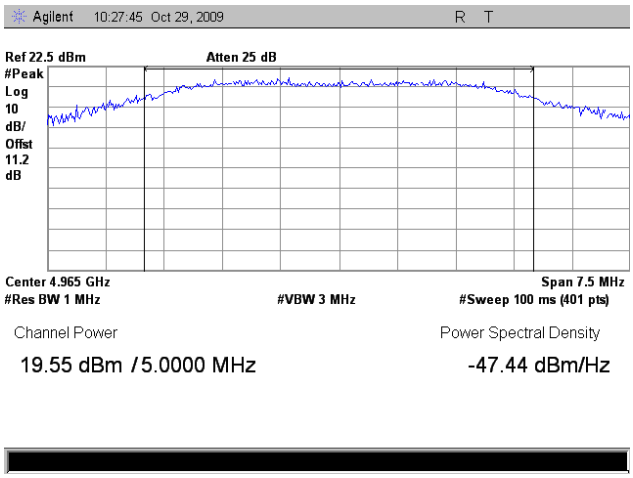


Plot 2. Low Channel RF Output Power, 10MHz

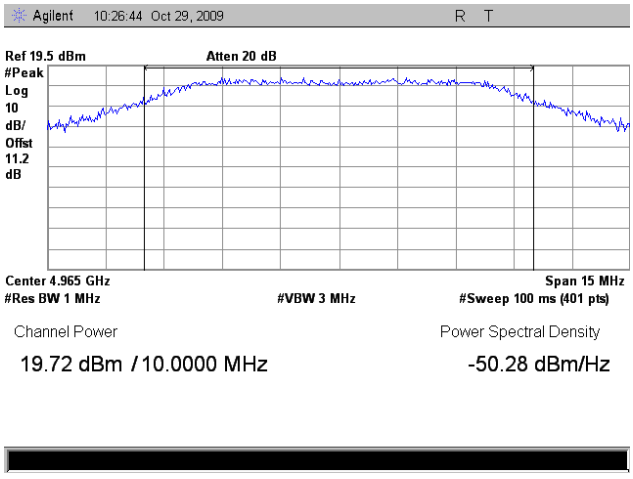


Plot 3. Low Channel RF Output Power, 20MHz

RF Power Output Power Test Results

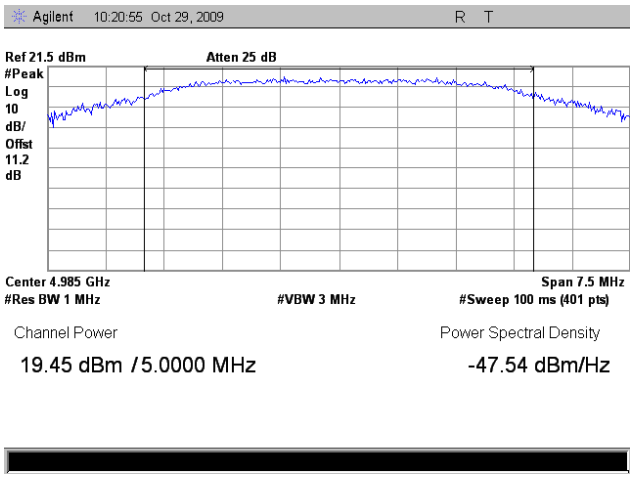


Plot 4. Mid Channel RF Output Power, 5MHz

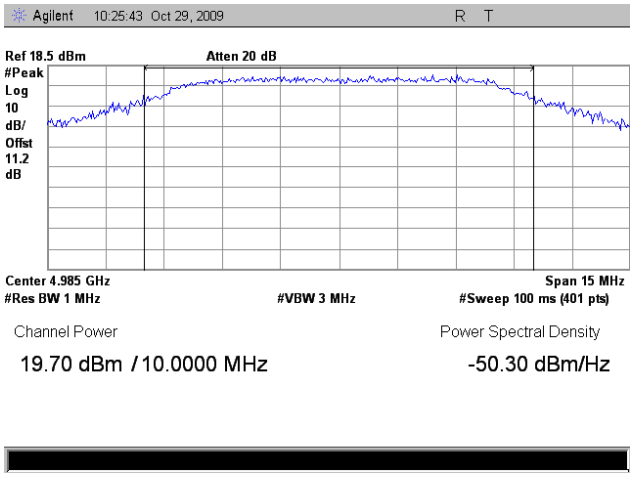


Plot 5. Mid Channel RF Output Power, 10MHz

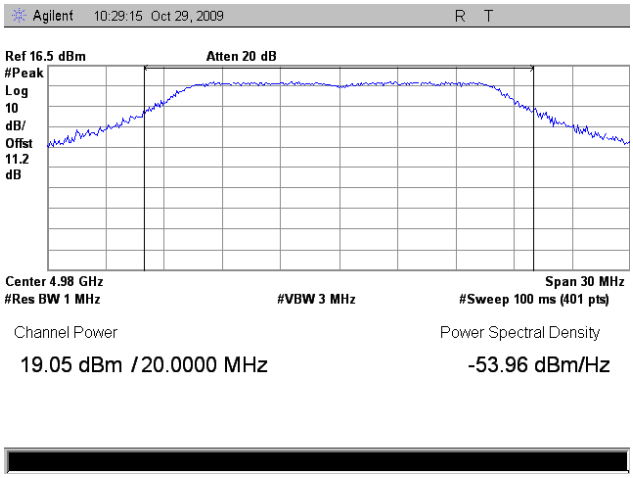
RF Power Output Power Test Results



Plot 6. High Channel RF Output Power, 5MHz



Plot 7. High Channel RF Output Power, 10MHz



Plot 8. High Channel RF Output Power, 20MHz

Electromagnetic Compatibility RF Power Output Requirements

§2.1046 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 Spectrum Analyzer.

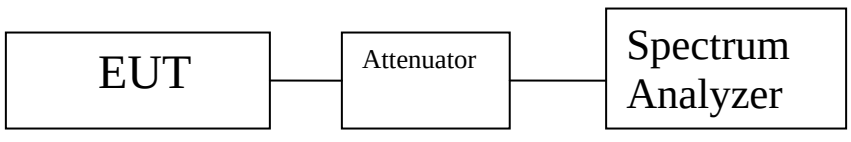
A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected to a Spectrum Analyzer in order to measure the power level. The Spectrum Analyzer was set to a RBW = 1 MHz, VBW = 3 MHz. The EUT power was adjusted at the maximum output power level. The max hold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

Test Results: The EUT is compliant with 47 CFR 2.1046 and 90.1215(a) with FCC 04-265 (High Power devices). The EUT does not exceed 21dBm/MHz peak power spectral density at the carrier frequency. All cable losses have been accounted for in the final SA readings.

Peak Power Spectral Density			
Frequency (MHz)	**EUT Channel Bandwidth (MHz)**	**Measured Power Spectral Density (dBm)**	**Limit (dBm)**
4945.0	5 MHz	13.78	21.00
4965.0		14.17	21.00
4985.0		13.3	21.00
4945.0	10 MHz	10.67	21.00
4965.0		10.41	21.00
4985.0		10.27	21.00
4950.0	20 MHz	5.916	21.00
4980.0		5.542	21.00

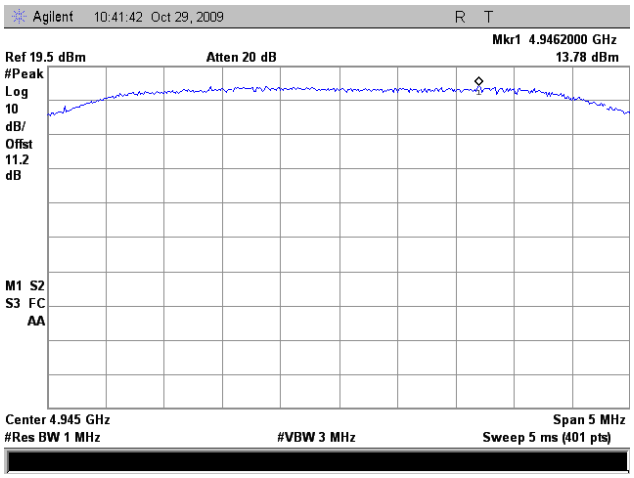
Test Engineer(s): Minh Ly

Test Date(s): October 29, 2009

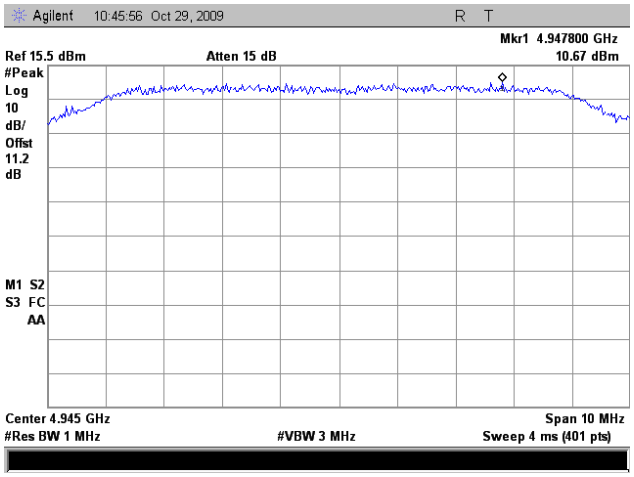


Block Diagram 2. Peak Power Spectral Density Test Setup

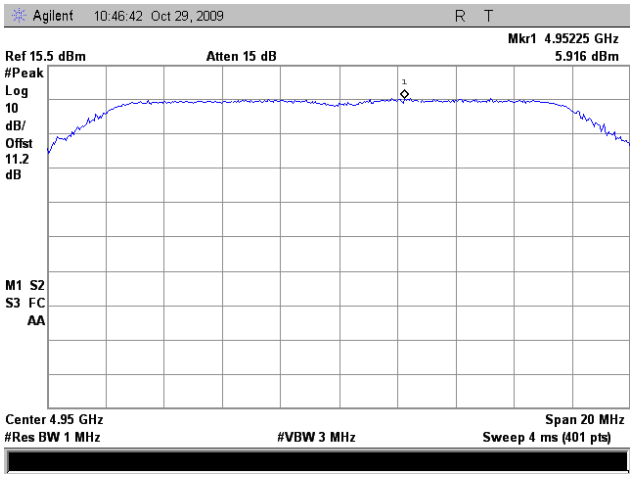
Peak Power Spectral Density Test Results



Plot 9. Low Channel Peak Spectral Density, 5MHz

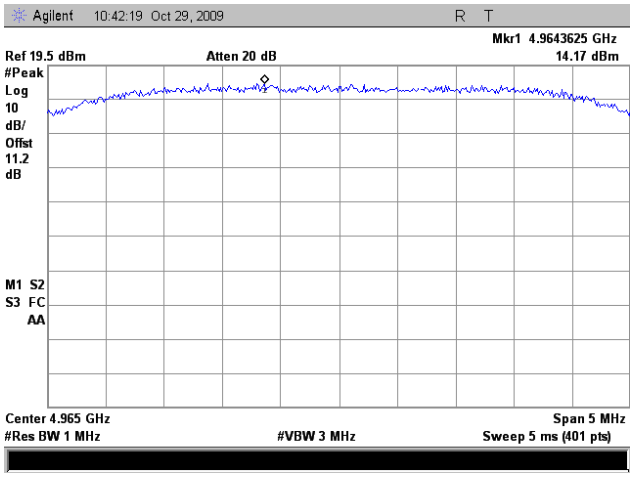


Plot 10. Low Channel Peak Spectral Density, 10MHz

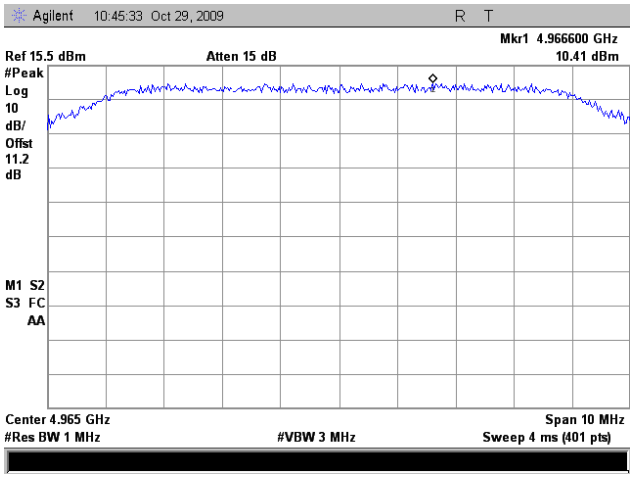


Plot 11. Low Channel Peak Spectral Density, 20MHz

Peak Power Spectral Density Test Results

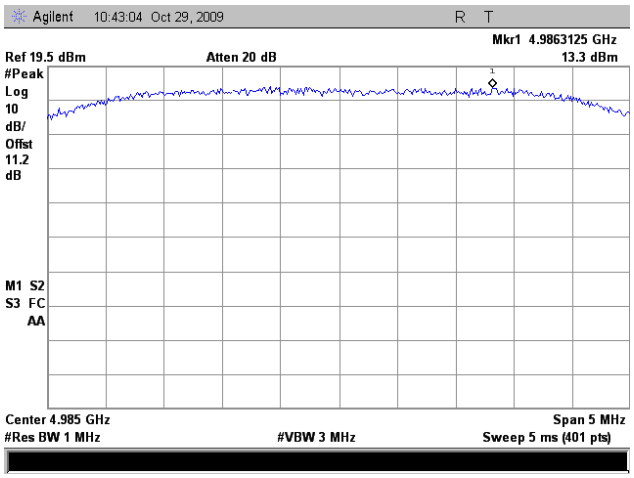


Plot 12. Mid Channel Peak Spectral Density, 5MHz

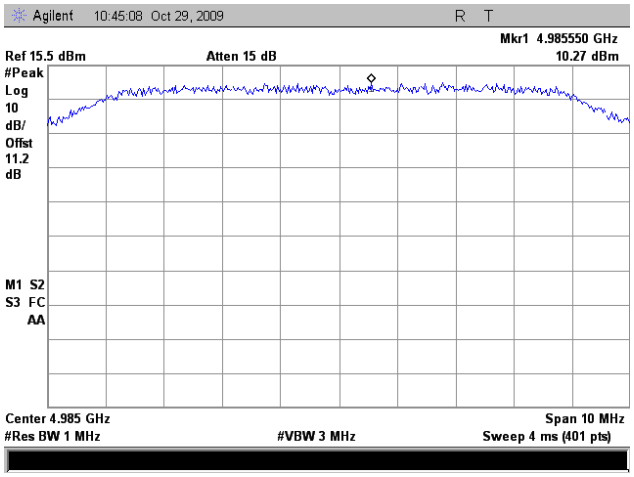


Plot 13. Mid Channel Peak Spectral Density, 10MHz

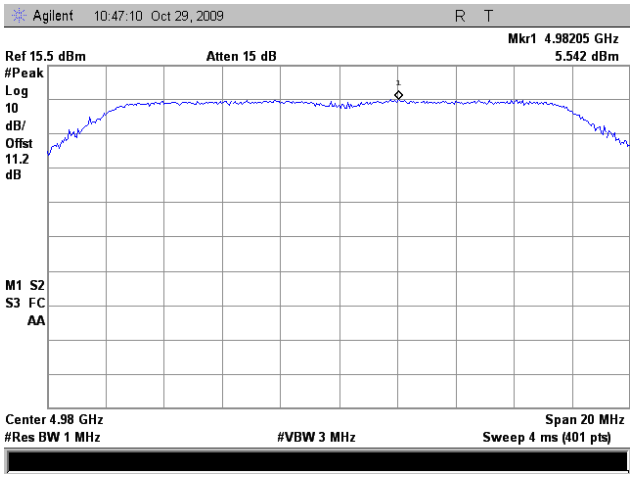
Peak Power Spectral Density Test Results



Plot 14. High Channel Peak Spectral Density, 5MHz



Plot 15. High Channel Peak Spectral Density, 10MHz



Plot 16. High Channel Peak Spectral Density, 20MHz

Electromagnetic Compatibility Occupied Bandwidth Requirements

§2.1049 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.

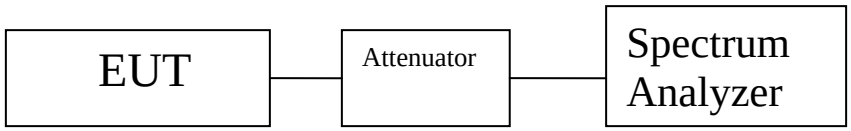
A laptop was connected to EUT to control the RF power output and frequency channel. The measured highest Average Power was set relative to zero dB reference. The RBW of the Spectrum Analyzer was set to at least 1% of the channel bandwidth. The EUT power was adjusted at the maximum output power level.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

Test Results: The EUT is compliant 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 and OBW plots.

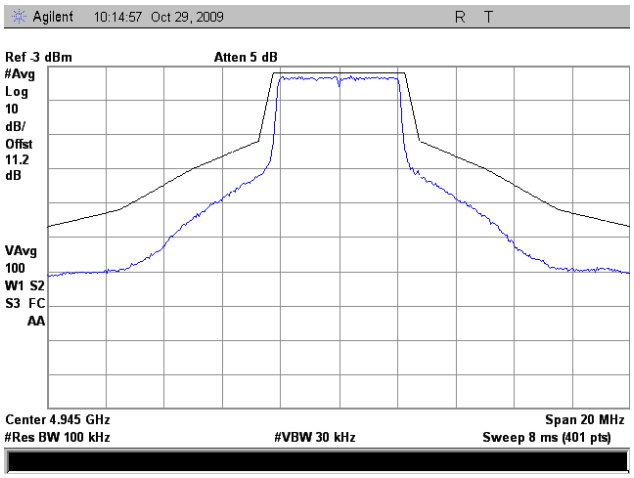
Test Engineer(s): Minh Ly

Test Date(s): 10/29/2009

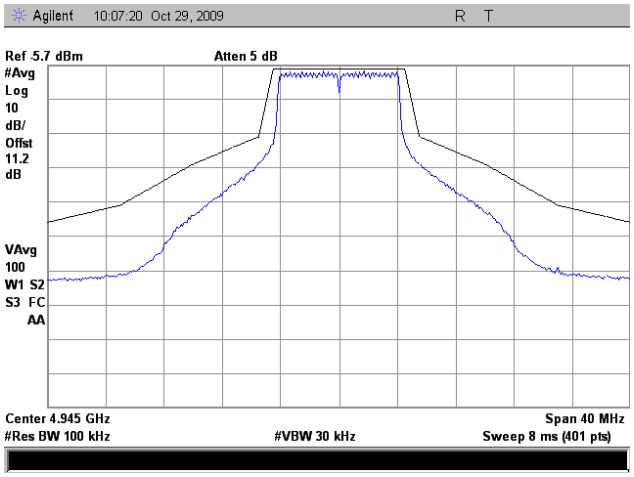


Block Diagram 3.Occupied Bandwidth Test Setup

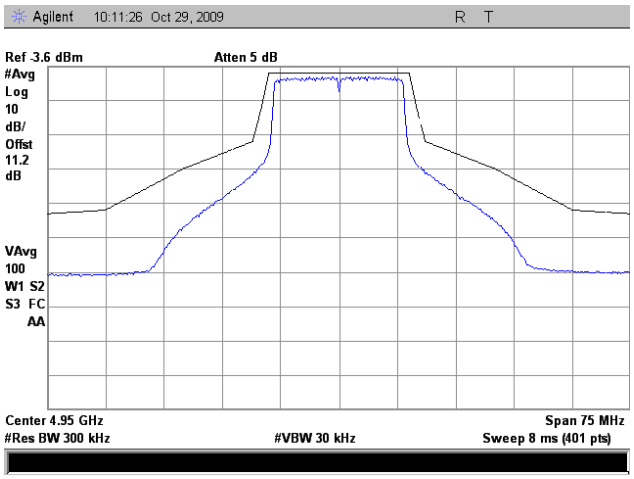
Emission Mask Test Results



Plot 17. Low Channel Emission Mask, 5MHz

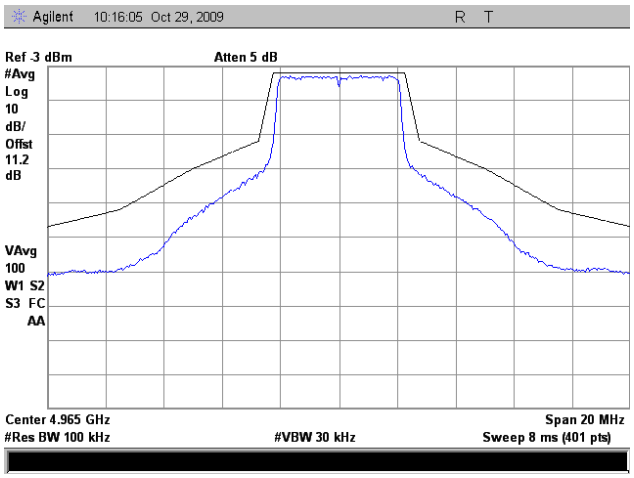


Plot 18. Low Channel Emission Mask, 10MHz

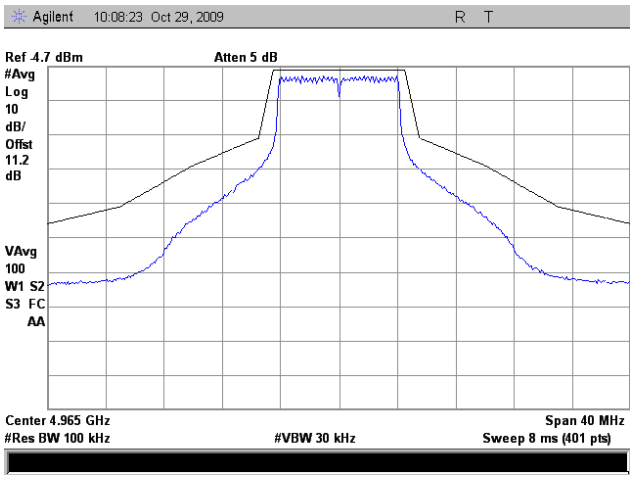


Plot 19. Low Channel Emission Mask, 20MHz

Emission Mask Test Results

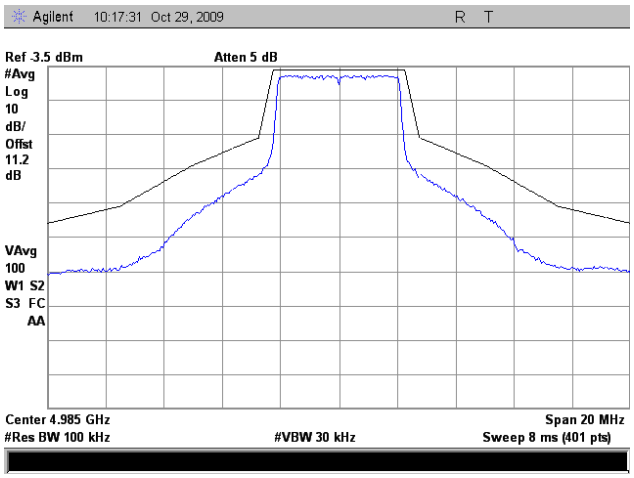


Plot 20. Mid Channel Emission Mask, 5MHz

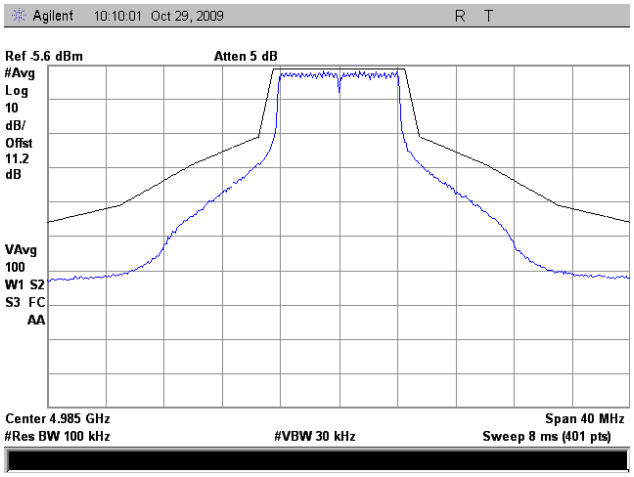


Plot 21. Mid Channel Emission Mask, 10MHz

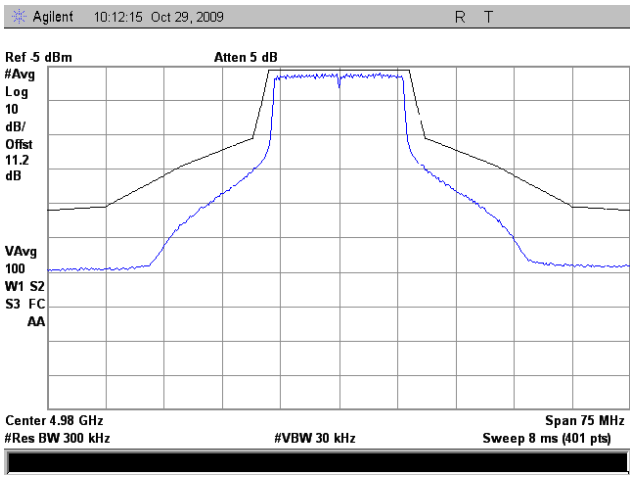
Emission Mask Test Results



Plot 22. High Channel Emission Mask, 5MHz

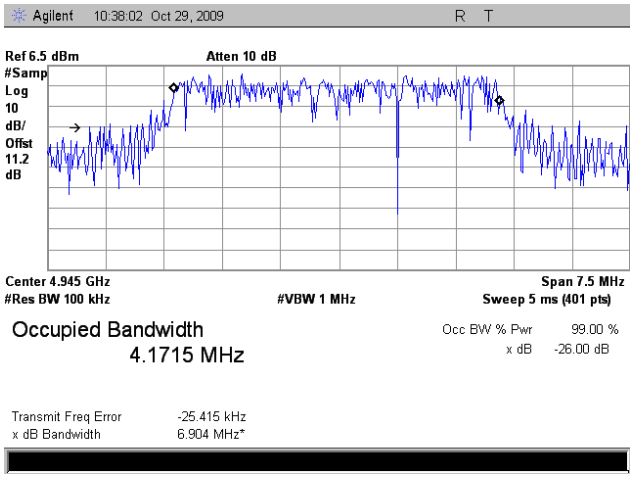


Plot 23. High Channel Emission Mask, 10MHz

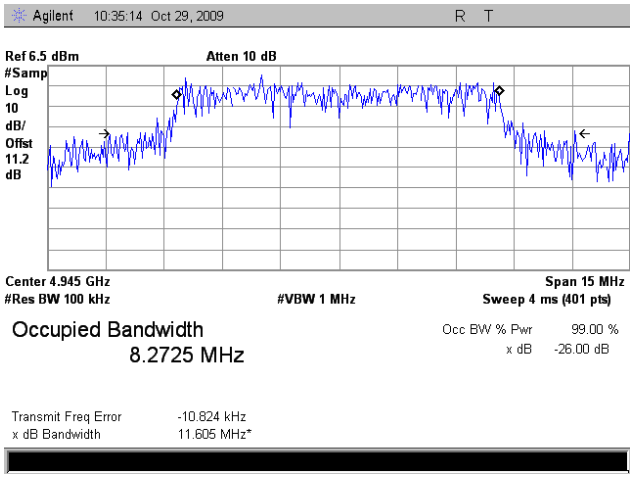


Plot 24. High Channel Emission Mask, 20MHz

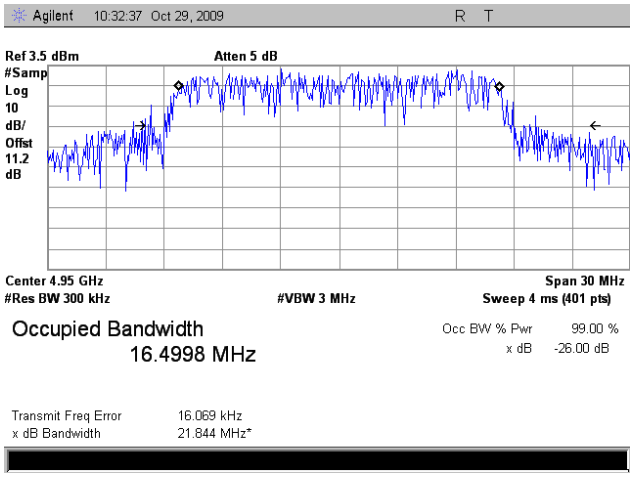
Occupied Bandwidth Test Results



Plot 25. Low Channel Occupied Bandwidth, 5MHz

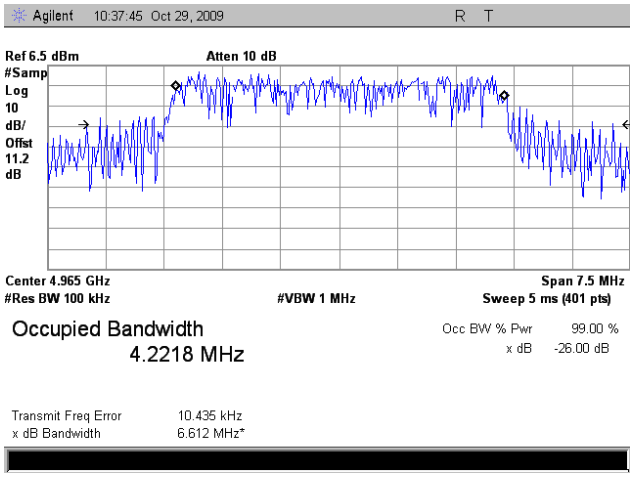


Plot 26. Low Channel Occupied Bandwidth, 10MHz

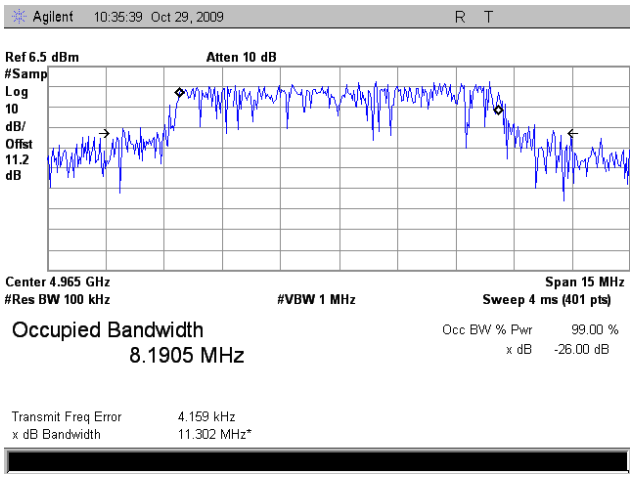


Plot 27. Low Channel Occupied Bandwidth, 20MHz

Occupied Bandwidth Test Results

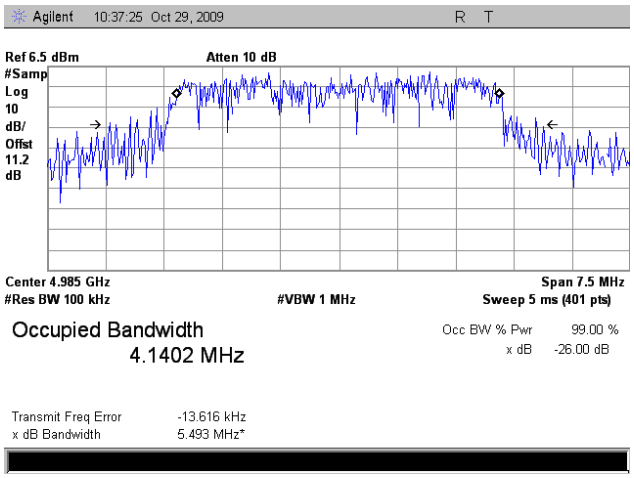


Plot 28. Mid Channel Occupied Bandwidth, 5MHz

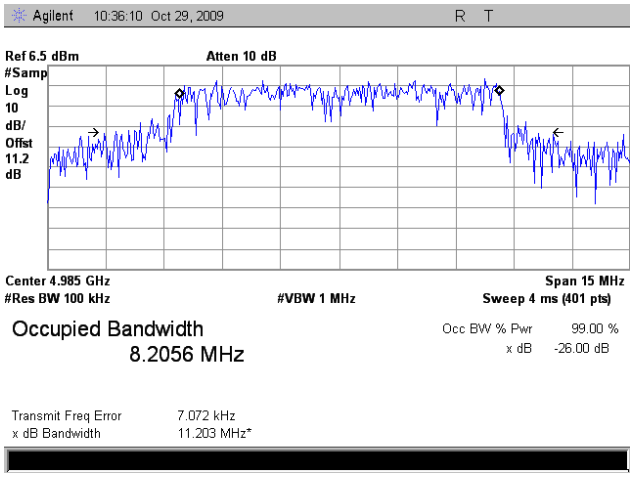


Plot 29. Mid Channel Occupied Bandwidth, 10MHz

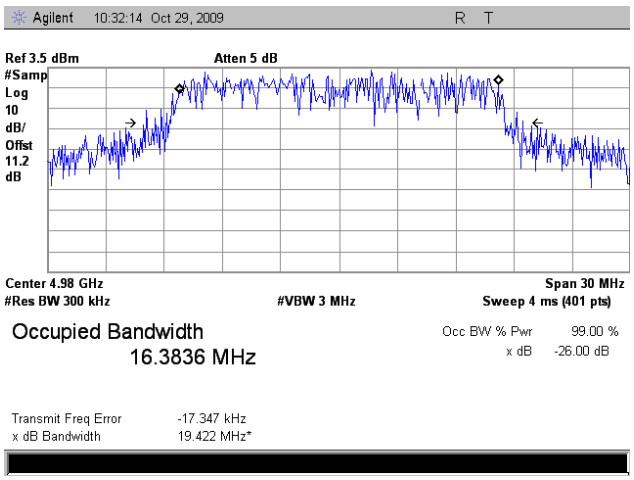
Occupied Bandwidth Test Results



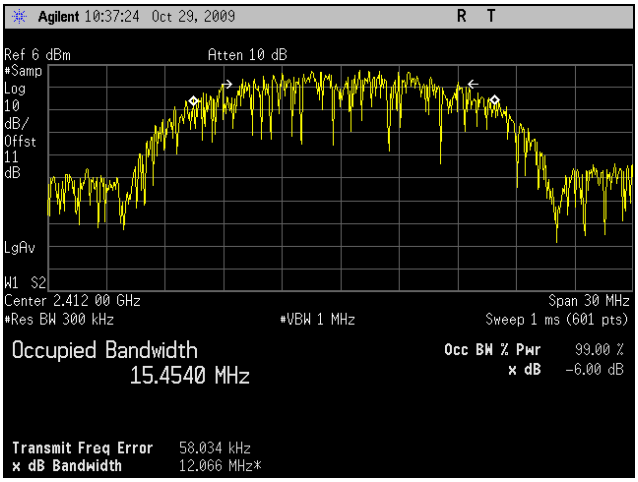
Plot 30. High Channel Occupied Bandwidth, 5MHz



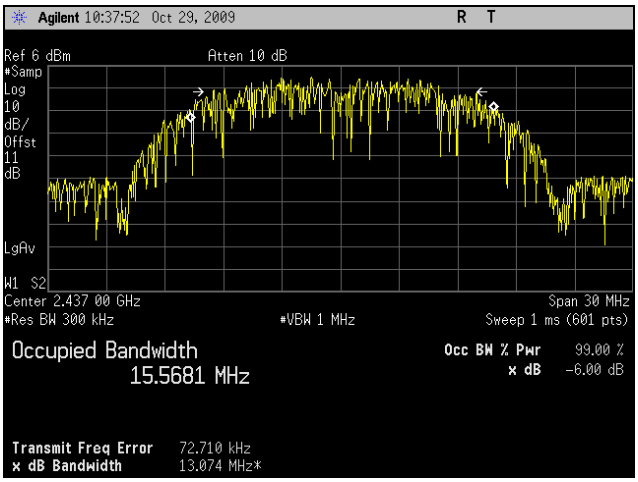
Plot 31. High Channel Occupied Bandwidth, 10MHz



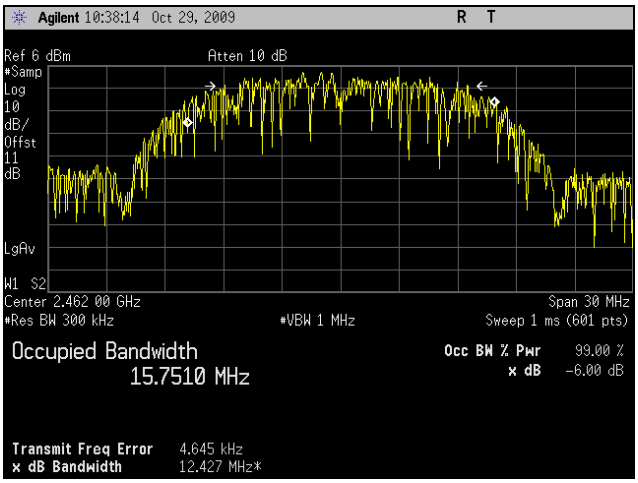
Plot 32. High Channel Occupied Bandwidth, 20MHz



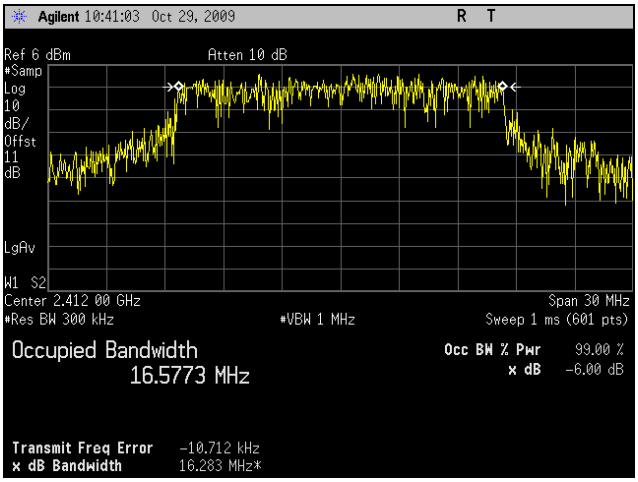
Plot 33. 802.11b Low Channel Occupied Band Width 99%



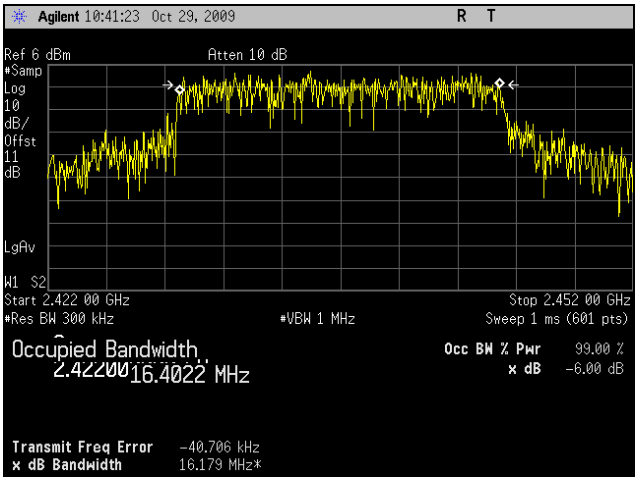
Plot 34. 802.11b Mid Channel Occupied Band Width 99%



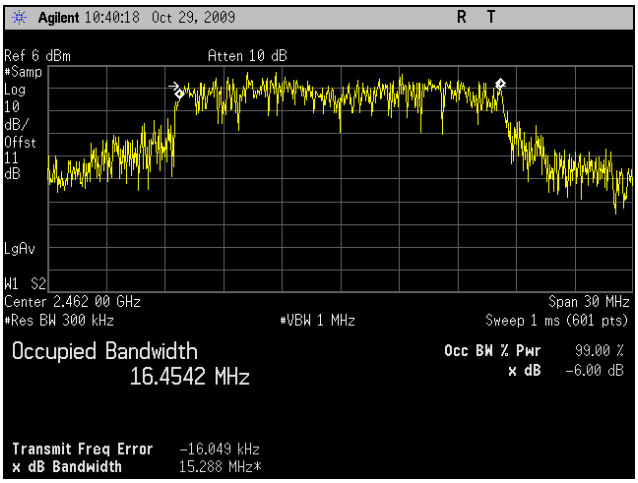
Plot 35. 802.11b High Channel Occupied Band Width 99%



Plot 36. 802.11g Low Channel Occupied Band Width 99%



Plot 37. 802.11g Mid Channel Occupied Band Width 99%



Plot 38. 802.11g High Channel Occupied Band Width 99%

Electromagnetic Compatibility Spurious Emissions at Antenna Terminal Requirements

§2.1051 Spurious Emissions at Antenna Terminals

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

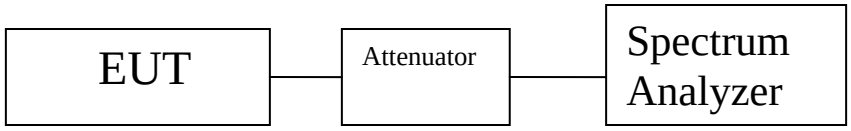
Test Procedures: As required by 47 CFR 2.1051, *spurious emissions at antenna terminal measurements* were made at the RF output terminals using a Spectrum Analyzer.

A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected to a Spectrum Analyzer 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 which ever is the lesser. Measurements were made at the low, mid and high channels.

Test Results: The EUT is compliant with Section 2.1051 and 90.210(M) with FCC 04-265.

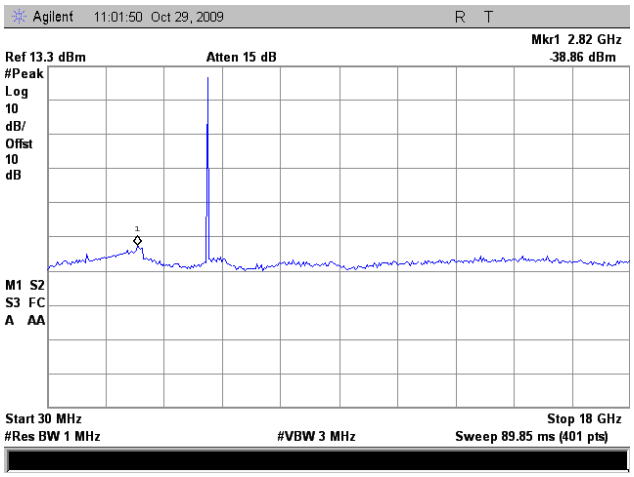
Test Engineer(s): Minh Ly

Test Date(s): 10/29/2009 & 11/2/2009

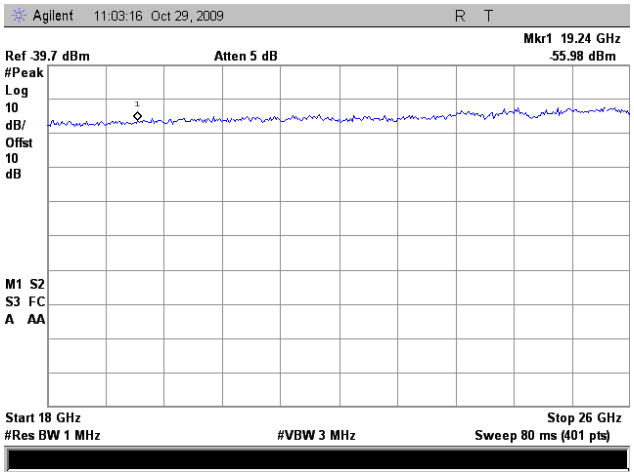


Block Diagram 4. Conducted Spurious Emissions Test Setup

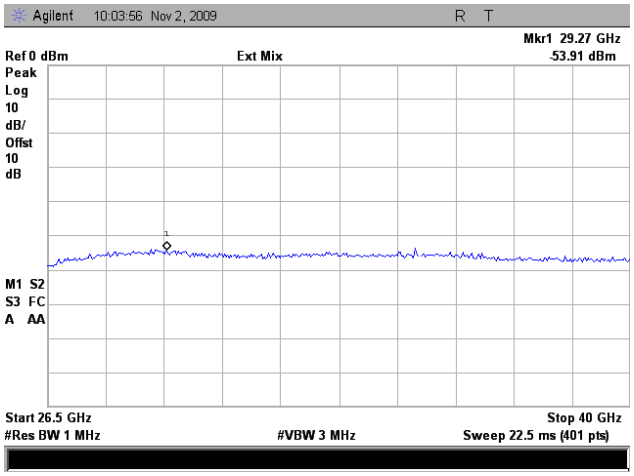
Conducted Spurious Emissions Test Results



Plot 39. Conducted Spurious Emissions (30MHz – 18GHz), Low Channel 5MHz

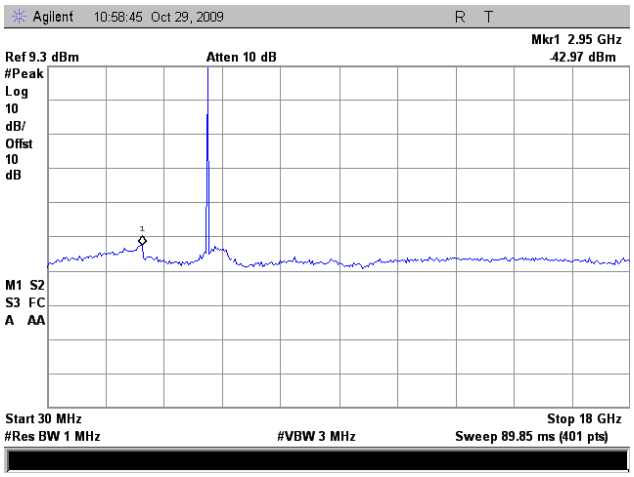


Plot 40. Conducted Spurious Emissions (18GHz – 26.5GHz), Low Channel 5MHz

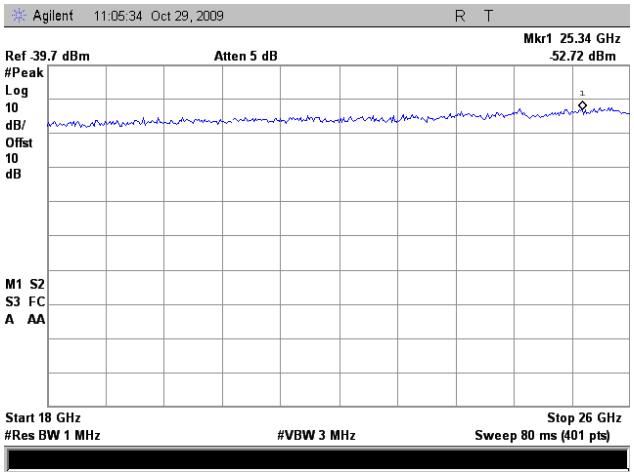


Plot 41. Conducted Spurious Emissions (26.5GHz – 40GHz), Low Channel 5MHz

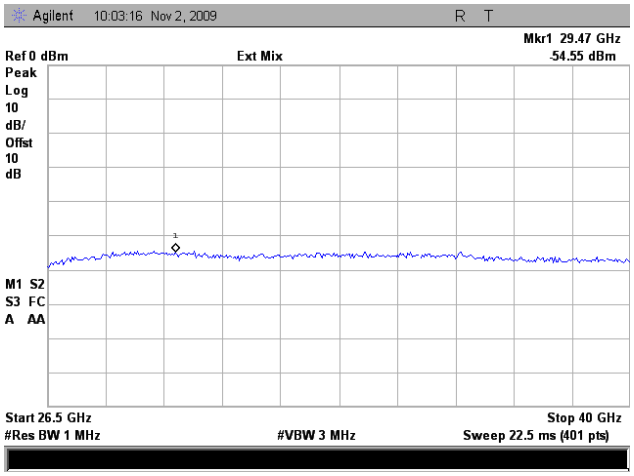
Conducted Spurious Emissions Test Results



Plot 42. Conducted Spurious Emissions (30MHz – 18GHz), Low Channel 10MHz

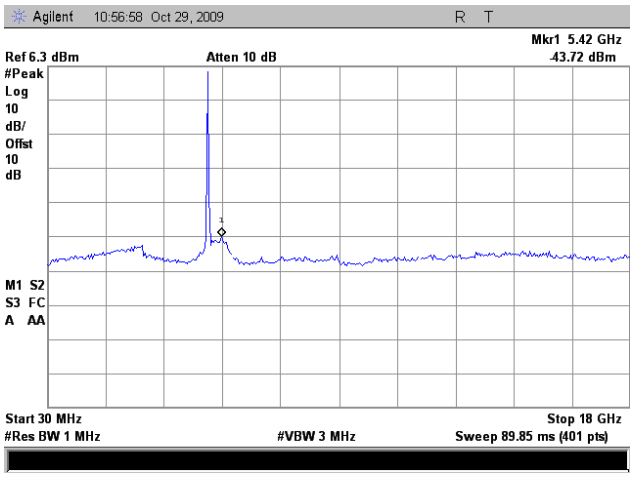


Plot 43. Conducted Spurious Emissions (18GHz – 26.5GHz), Low Channel 10MHz

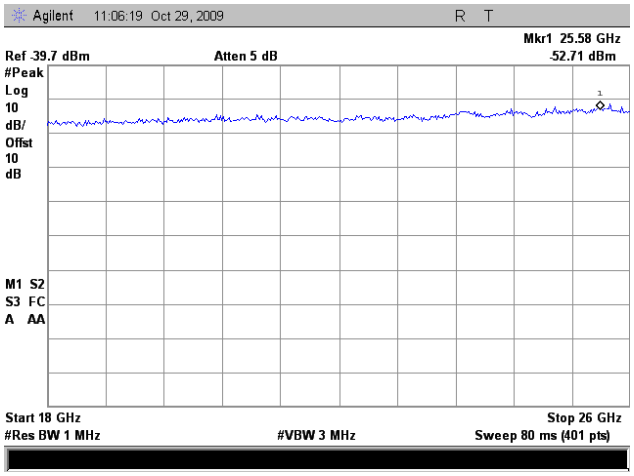


Plot 44. Conducted Spurious Emissions (26.5GHz – 40GHz), Low Channel 10MHz

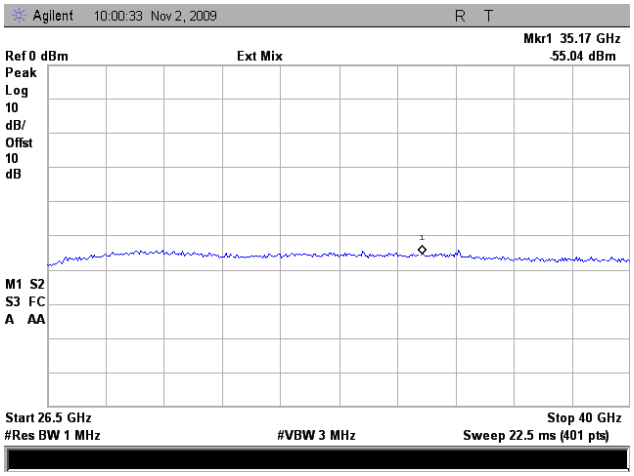
Conducted Spurious Emissions Test Results



Plot 45. Conducted Spurious Emissions (30MHz – 18GHz), Low Channel 20MHz

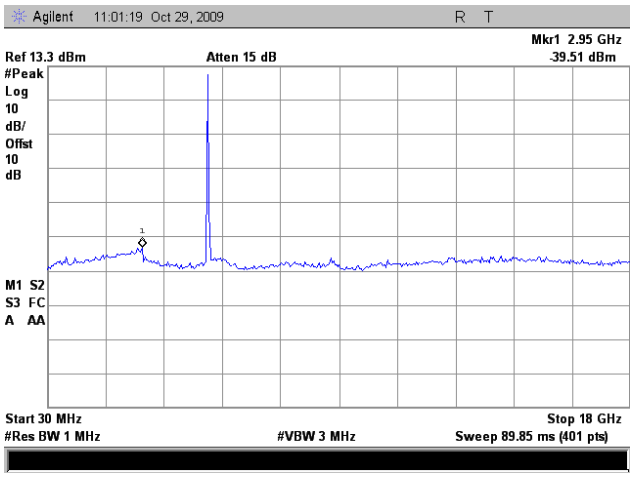


Plot 46. Conducted Spurious Emissions (18GHz – 26.5GHz), Low Channel 20MHz

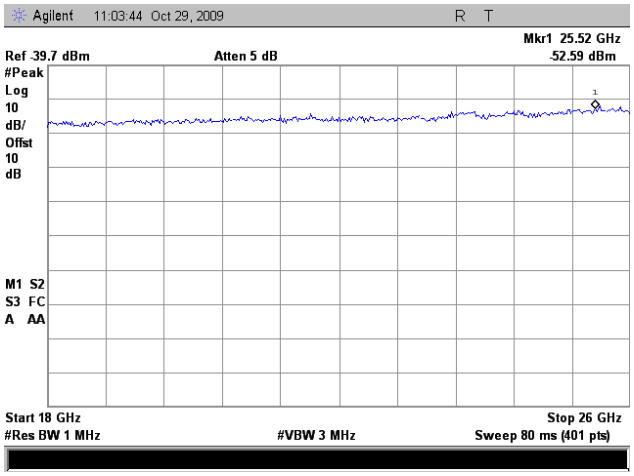


Plot 47. Conducted Spurious Emissions (26.5GHz – 40GHz), Low Channel 20MHz

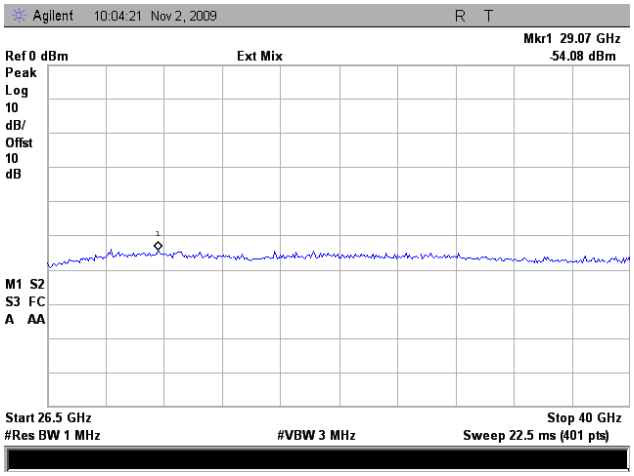
Conducted Spurious Emissions Test Results



Plot 48. Conducted Spurious Emissions (30MHz – 18GHz), Mid Channel 5MHz

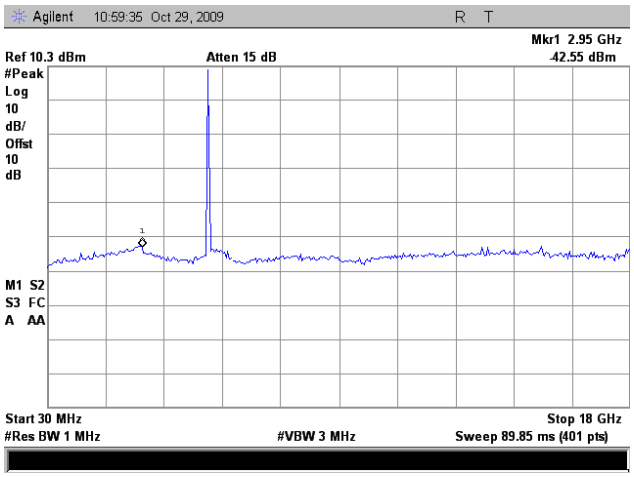


Plot 49. Conducted Spurious Emissions (18GHz – 26.5GHz), Mid Channel 5MHz

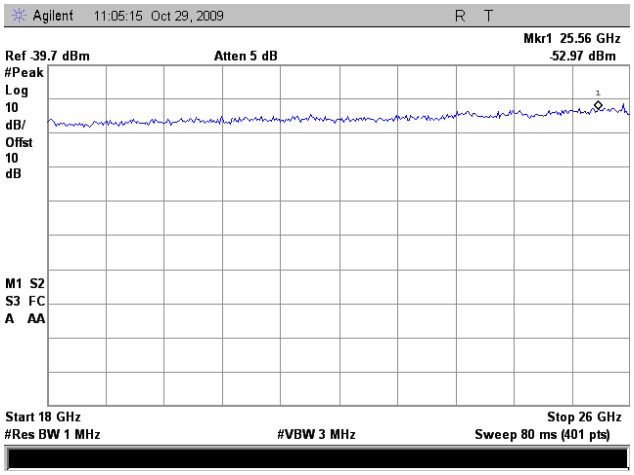


Plot 50. Conducted Spurious Emissions (26.5GHz – 40GHz), Mid Channel 5MHz

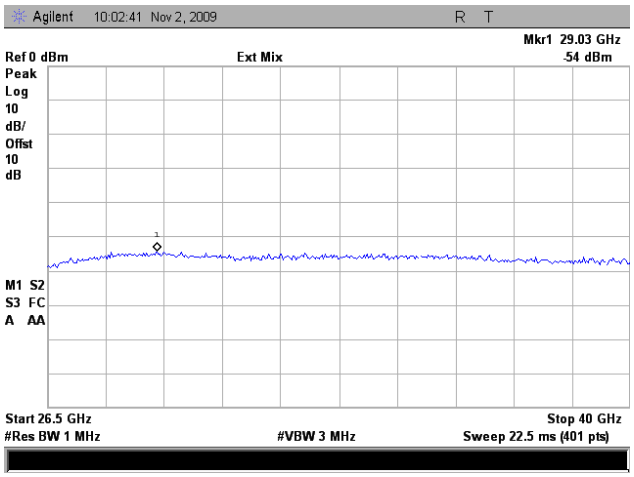
Conducted Spurious Emissions Test Results



Plot 51. Conducted Spurious Emissions (30MHz – 18GHz), Mid Channel 10MHz

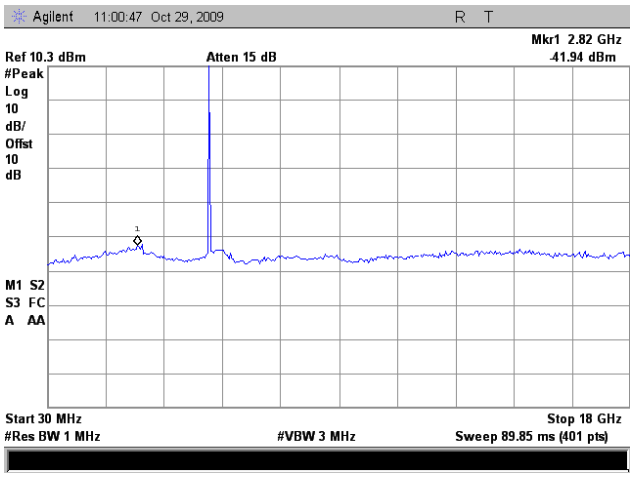


Plot 52. Conducted Spurious Emissions (18GHz – 26.5GHz), Mid Channel 10MHz

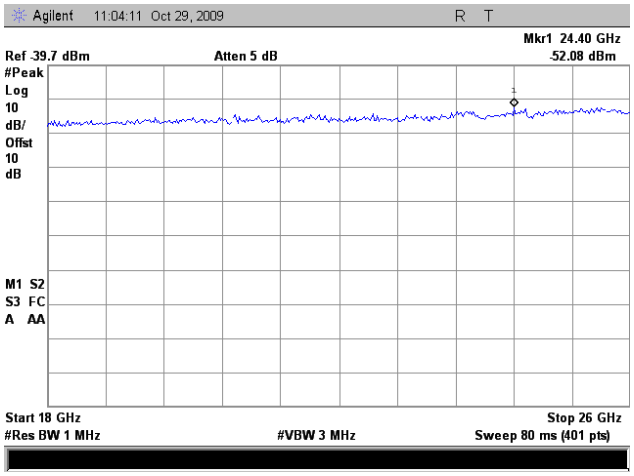


Plot 53. Conducted Spurious Emissions (26.5GHz – 40GHz), Mid Channel 10MHz

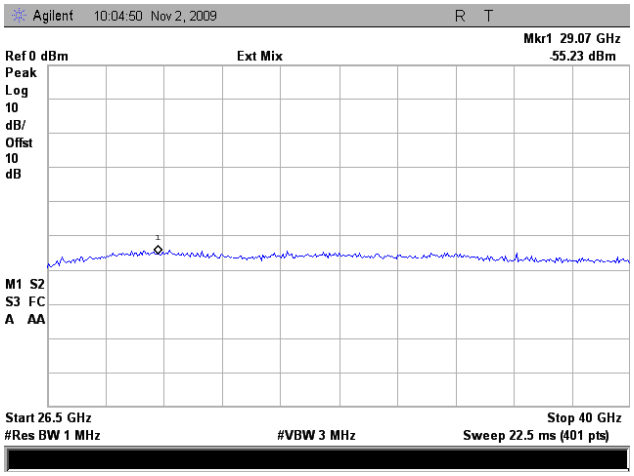
Conducted Spurious Emissions Test Results



Plot 54. Conducted Spurious Emissions (30MHz – 18GHz), High Channel 5MHz

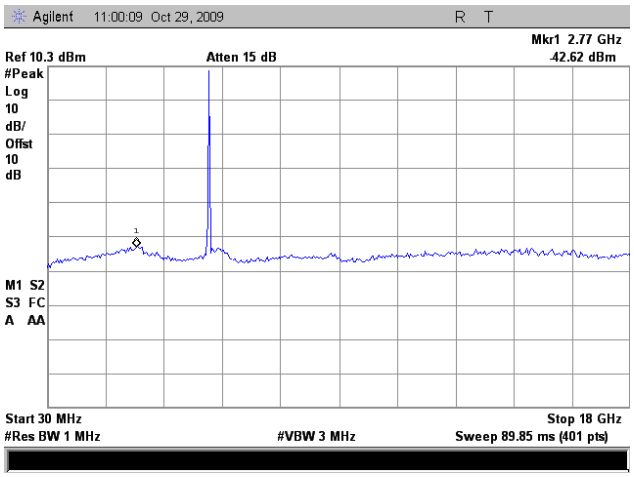


Plot 55. Conducted Spurious Emissions (18GHz – 26.5GHz), High Channel 5MHz

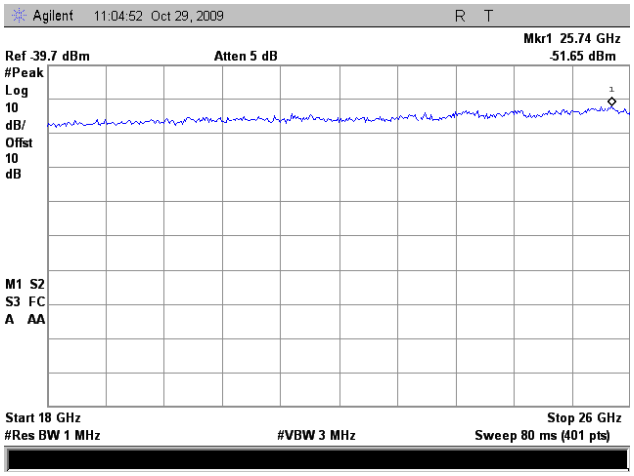


Plot 56. Conducted Spurious Emissions (26.5GHz – 40GHz), High Channel 5MHz

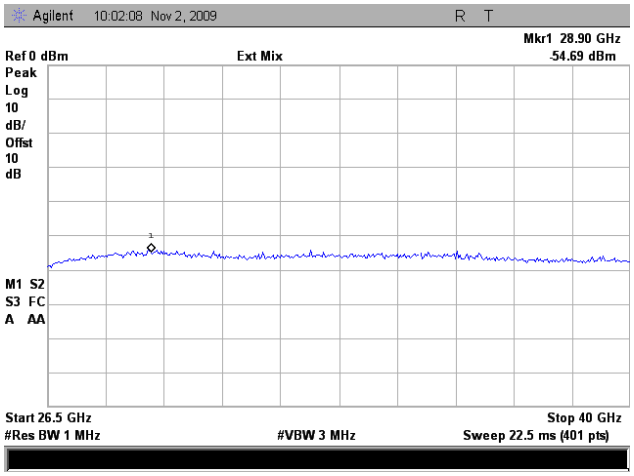
Conducted Spurious Emissions Test Results



Plot 57. Conducted Spurious Emissions (30MHz – 18GHz), High Channel 10MHz

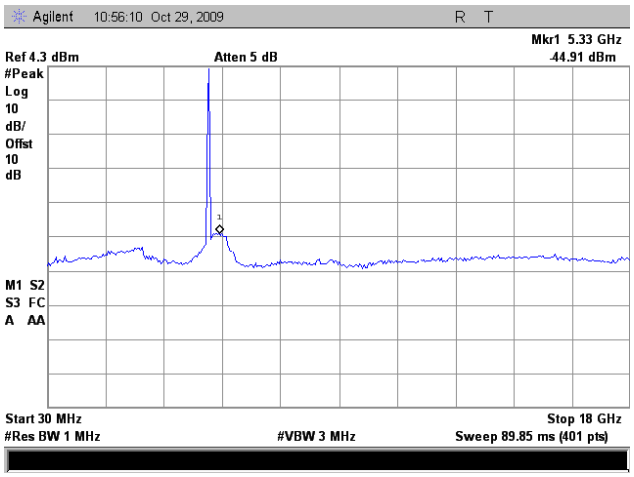


Plot 58. Conducted Spurious Emissions (18GHz – 26.5GHz), High Channel 10MHz

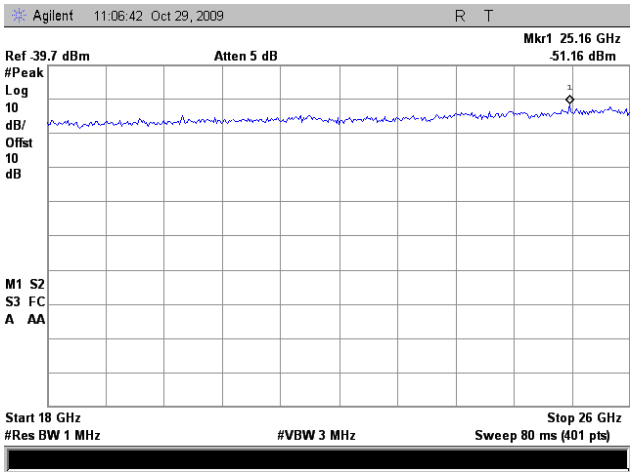


Plot 59. Conducted Spurious Emissions (26.5GHz – 40GHz), High Channel 10MHz

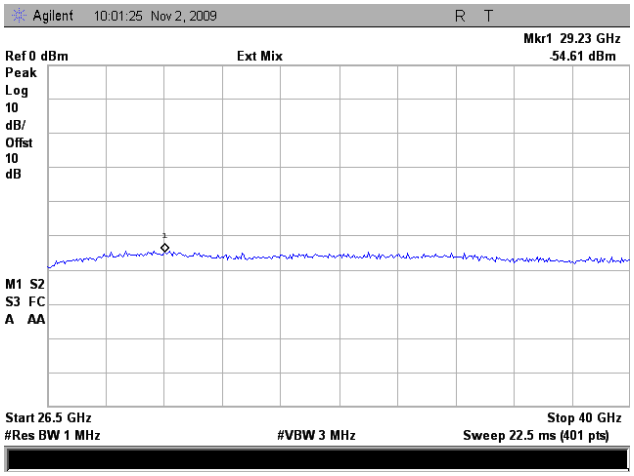
Conducted Spurious Emissions Test Results



Plot 60. Conducted Spurious Emissions (30MHz – 18GHz), High Channel 20MHz



Plot 61. Conducted Spurious Emissions (18GHz – 26.5GHz), High Channel 20MHz



Plot 62. Conducted Spurious Emissions (26.5GHz – 40GHz), High Channel 20MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

RSS-GEN Receiver Spurious Emissions Requirements

Test Requirements: 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 5.

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

Table 5. 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 Procedures: The EUT was programmed for receive mode only. Conducted measurements were taken at the antenna port of the EUT. 100 kHz resolution bandwidth was used from 30 MHz - 1 GHz and 300 kHz resolution was used for measurements done above 1 GHz. All plots are corrected for cable loss.

Test Results: Equipment is compliant with the Receiver Spurious Emissions Requirements of RSS-GEN.

Test Engineer(s): Minh Ly

Test Date(s): 01/26/11

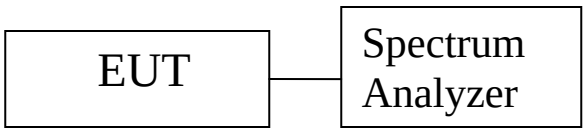
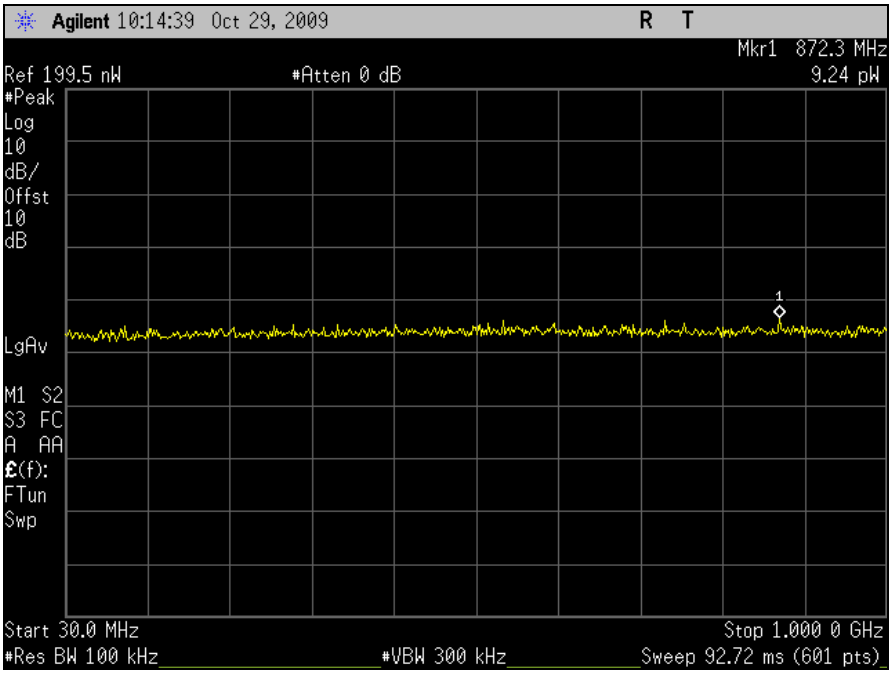
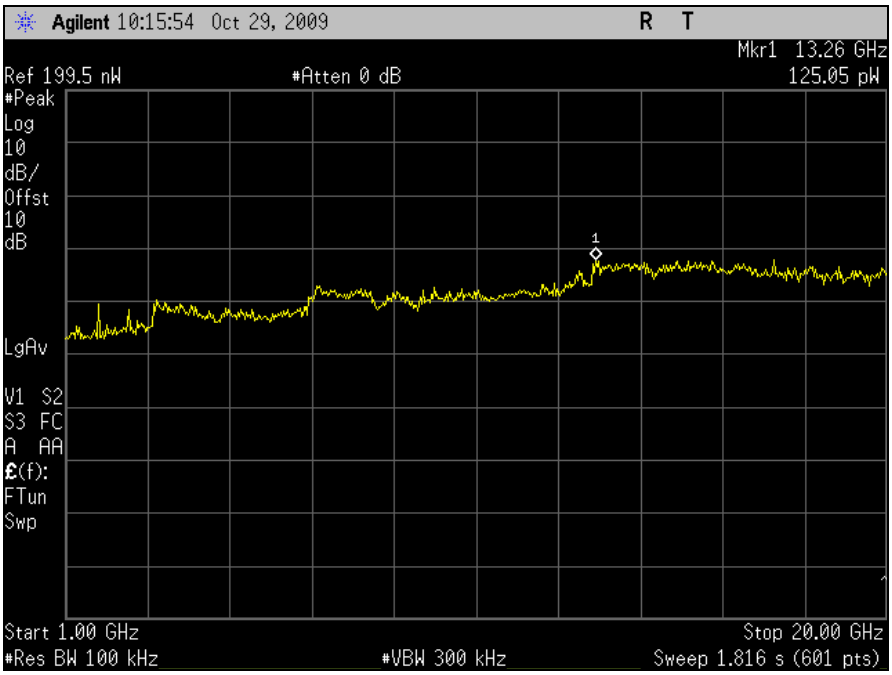


Figure 2. Block Diagram, Conducted Receiver Spurious Emissions Test Setup

Conducted Receiver Spurious Emissions



Plot 63. Receiver Spurious Emission, 30 MHz – 1 GHz



Plot 64. Receiver Spurious Emission, 1 GHz – 20 GHz

Electromagnetic Compatibility Radiated Emissions Requirements

§2.1053 Radiated Emissions

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".

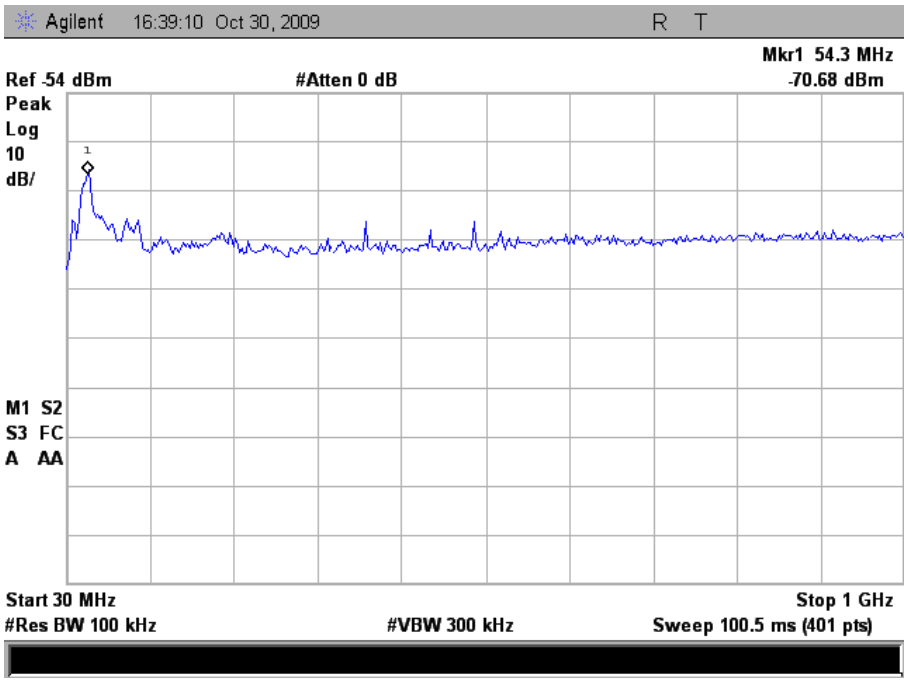
Radiated emission measurements were performed inside a semi-anechoic chamber. The EUT was set at a distance of 3m from the receiving antenna. The EUT's RF ports were terminated to 50ohm load. The EUT was set to transmit at the low, mid and high channels of the transmitter frequency range at its maximum 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.

Test Results: The EUT is compliant with Section 2.1053 and 90.210.

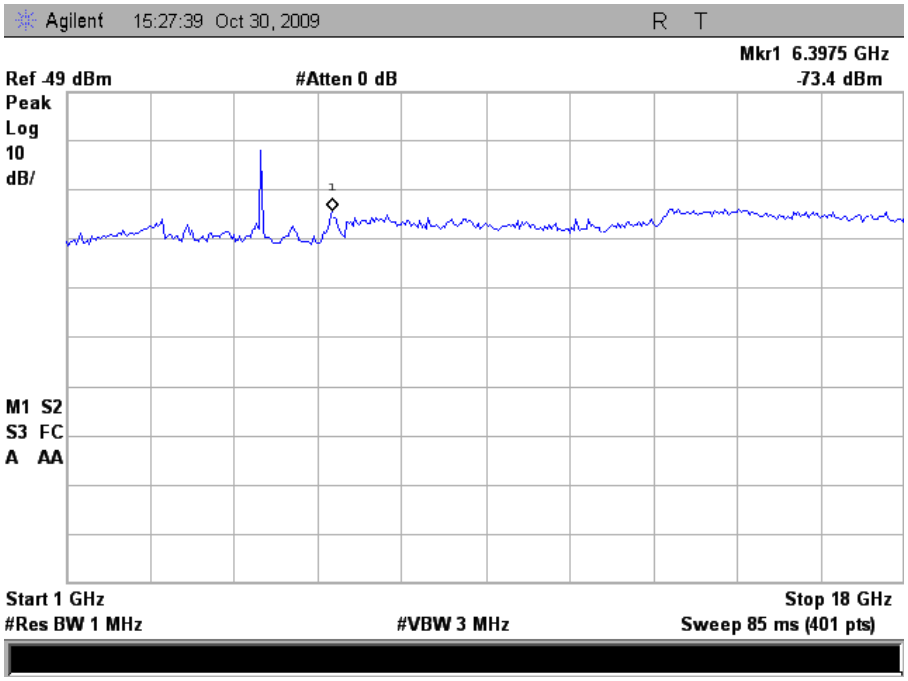
Test Engineer(s): Minh Ly

Test Date(s): 10/30/2009

Radiated Spurious Emissions Test Results

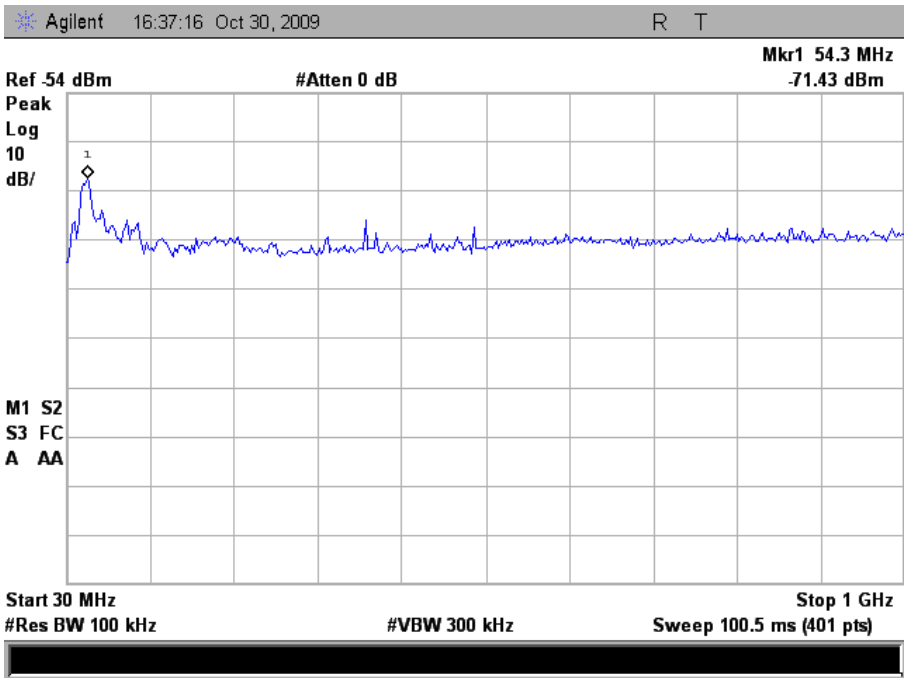


Plot 65. Radiated Spurious Emissions (30MHz – 1GHz), Low Channel 5MHz

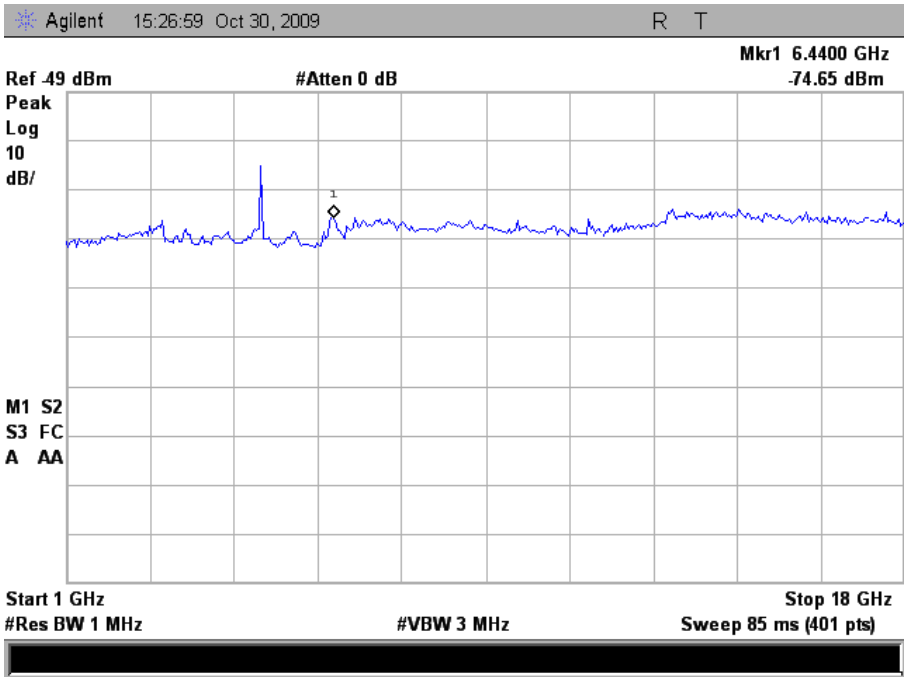


Plot 66. Radiated Spurious Emissions (1GHz – 18GHz), Low Channel 5MHz

Radiated Spurious Emissions Test Results

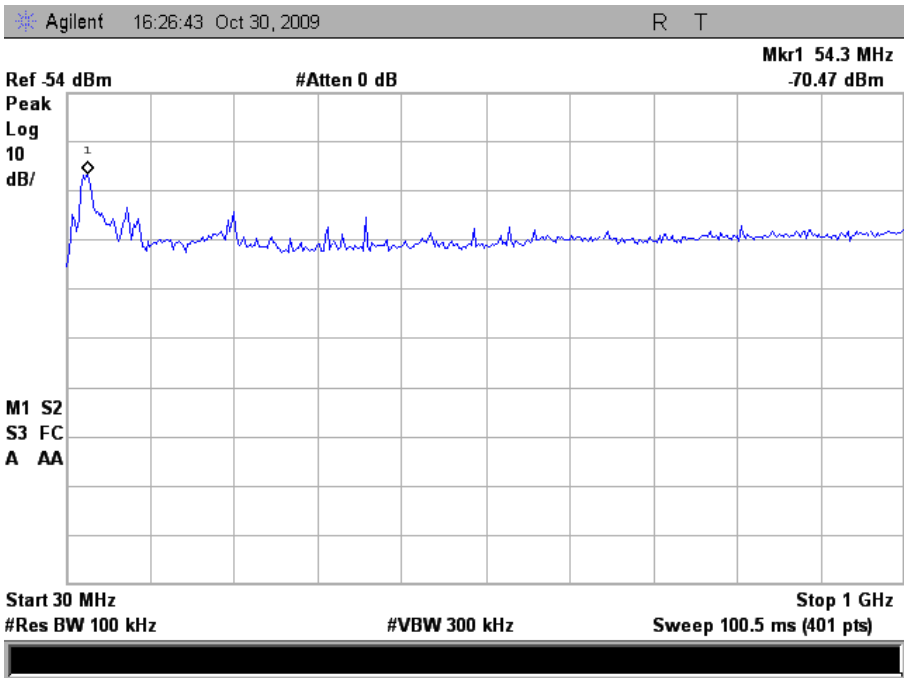


Plot 67. Radiated Spurious Emissions (30MHz – 1GHz), Low Channel 10MHz

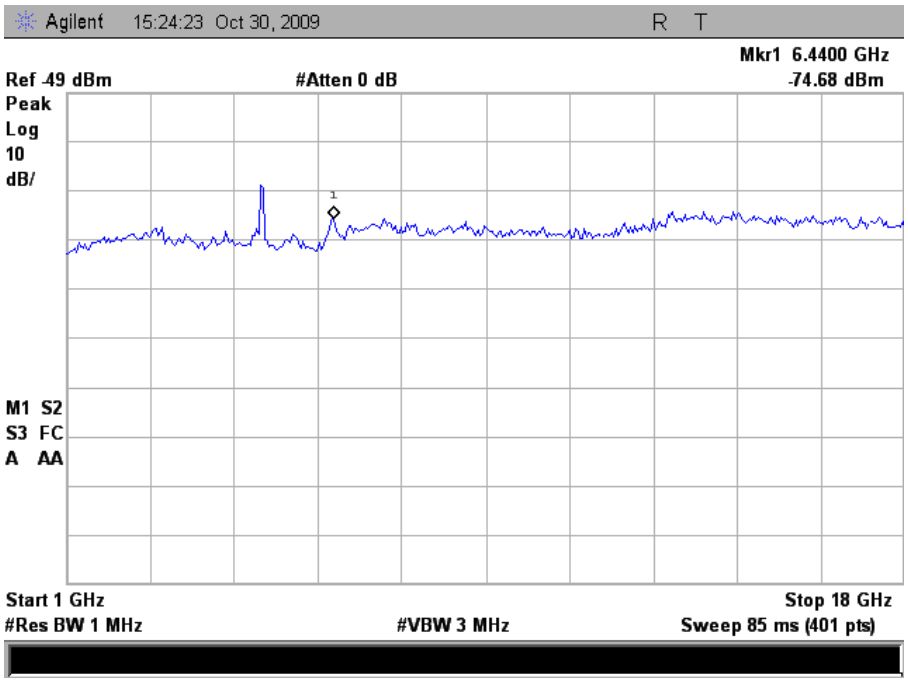


Plot 68. Radiated Spurious Emissions (1GHz – 18GHz), Low Channel 10MHz

Radiated Spurious Emissions Test Results

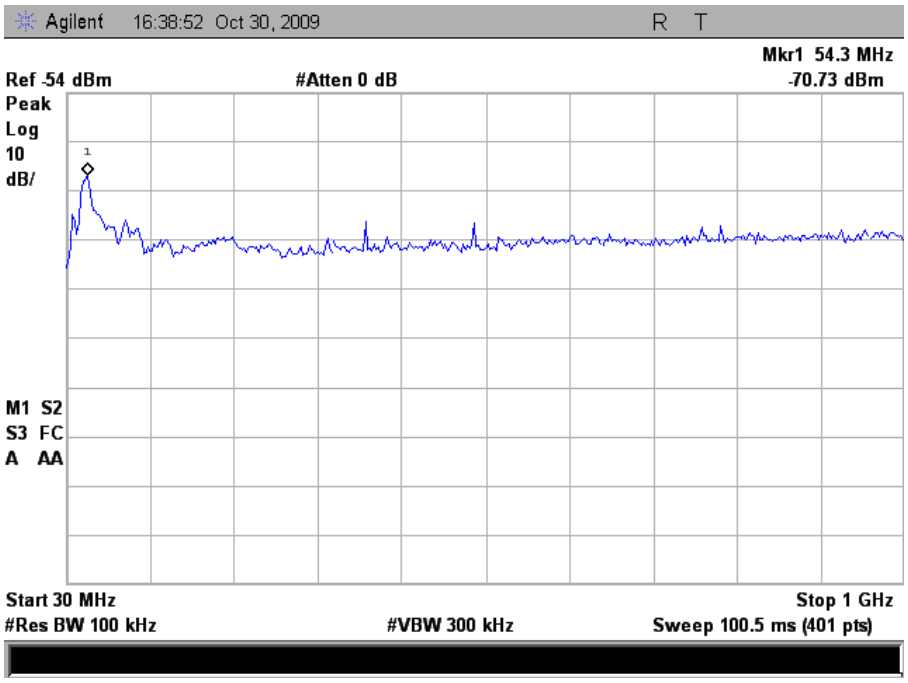


Plot 69. Radiated Spurious Emissions (30MHz – 1GHz), Low Channel 20MHz

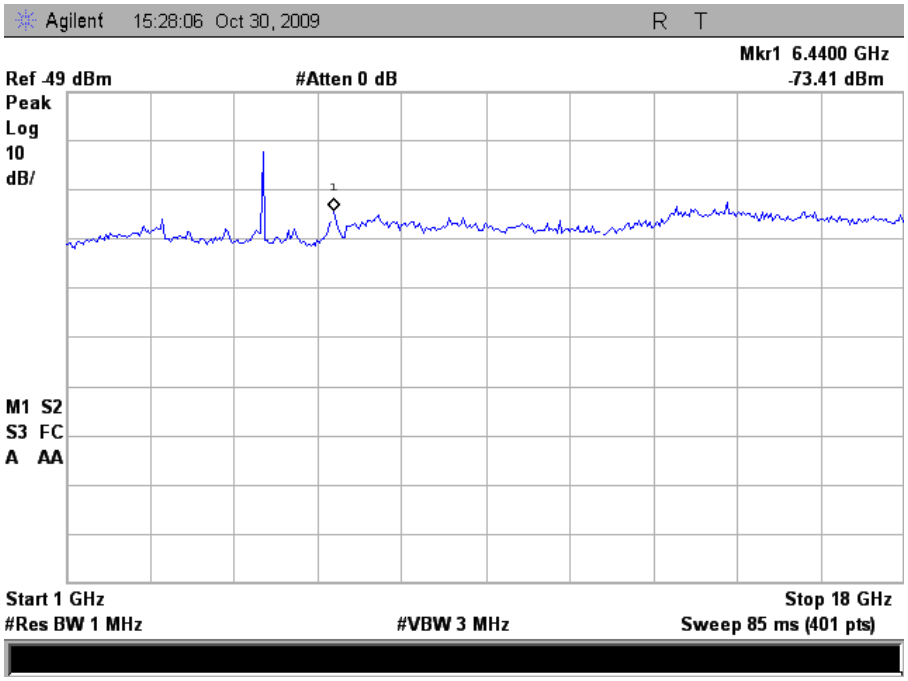


Plot 70. Radiated Spurious Emissions (1GHz – 18GHz), Low Channel 20MHz

Radiated Spurious Emissions Test Results

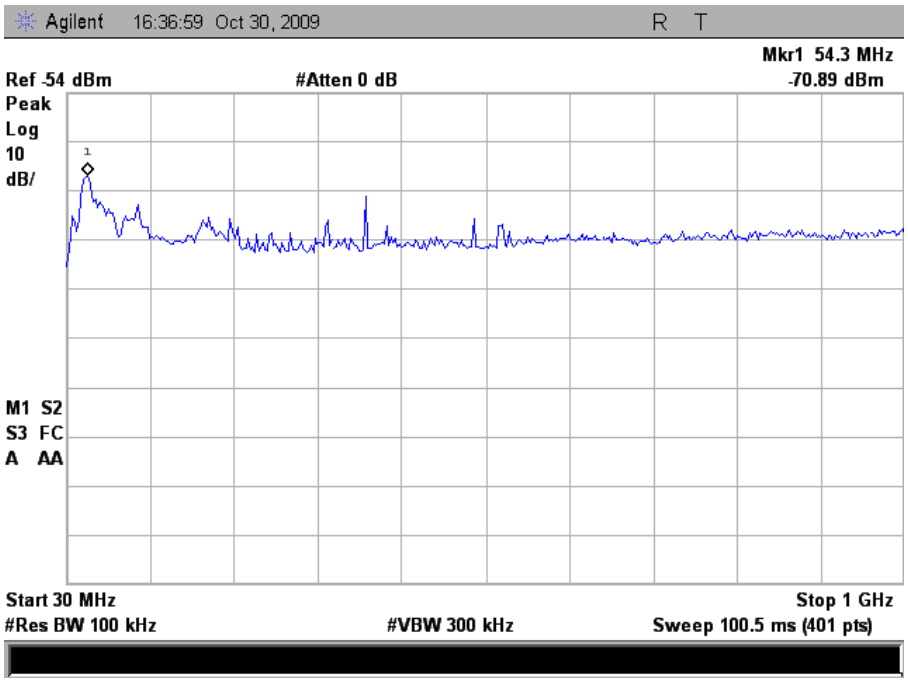


Plot 71. Radiated Spurious Emissions (30MHz – 1GHz), Mid Channel 5MHz

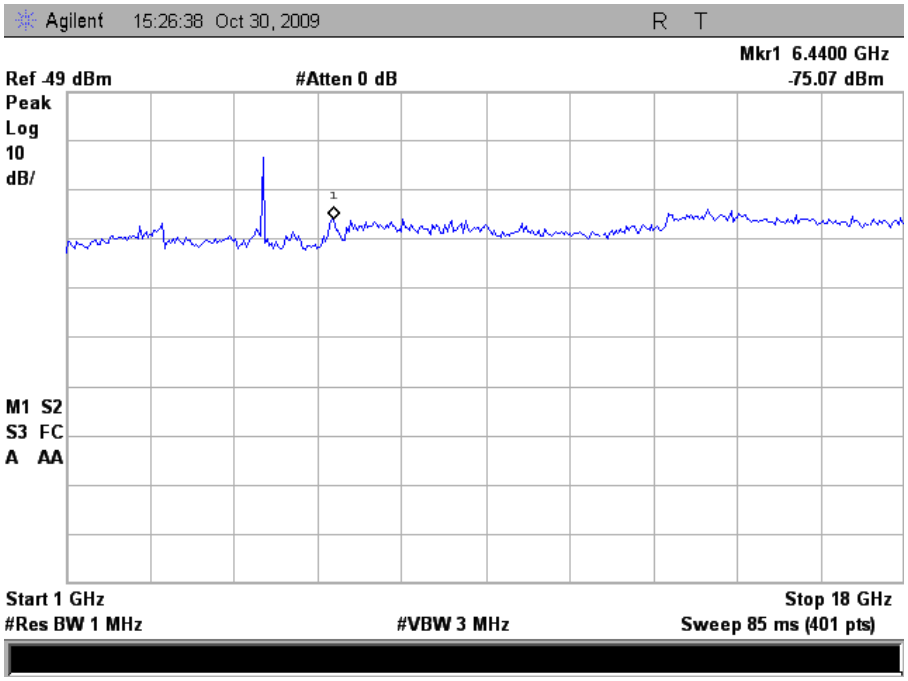


Plot 72. Radiated Spurious Emissions (1GHz – 18GHz), Mid Channel 5MHz

Radiated Spurious Emissions Test Results

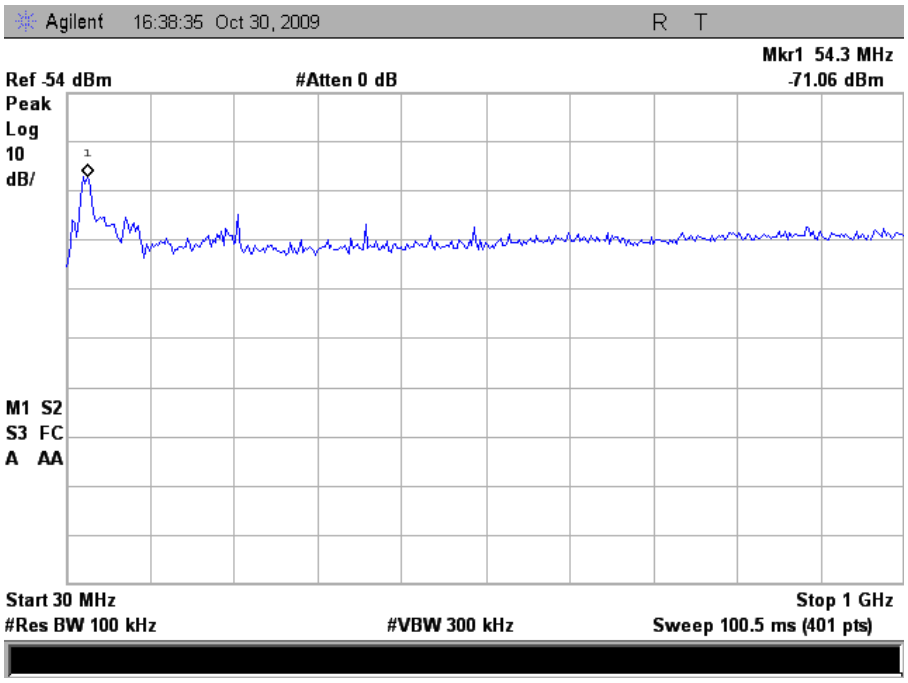


Plot 73. Radiated Spurious Emissions (30MHz – 1GHz), Mid Channel 10MHz

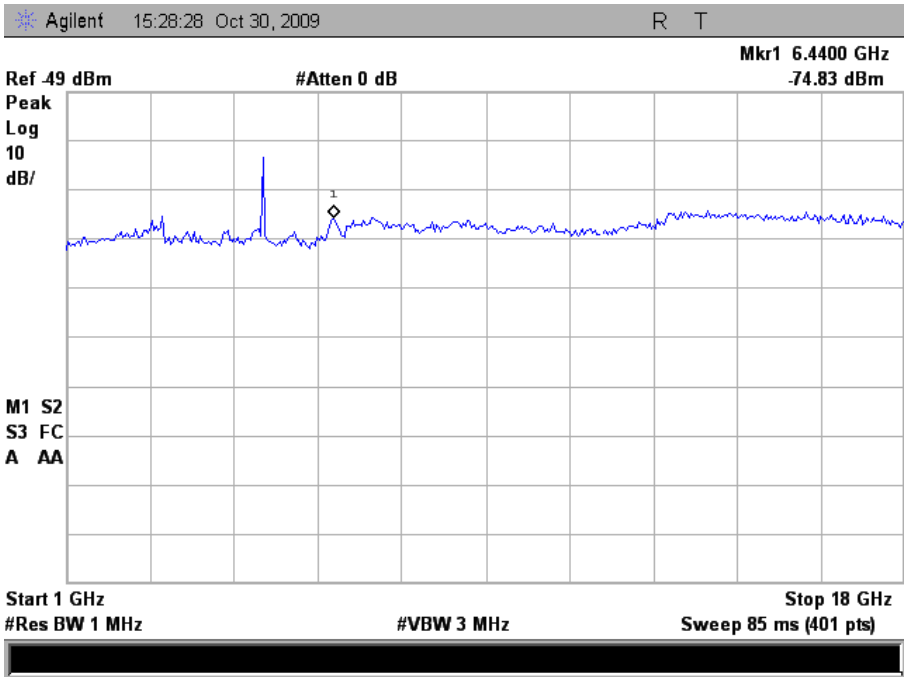


Plot 74. Radiated Spurious Emissions (1GHz – 18GHz), Mid Channel 10MHz

Radiated Spurious Emissions Test Results

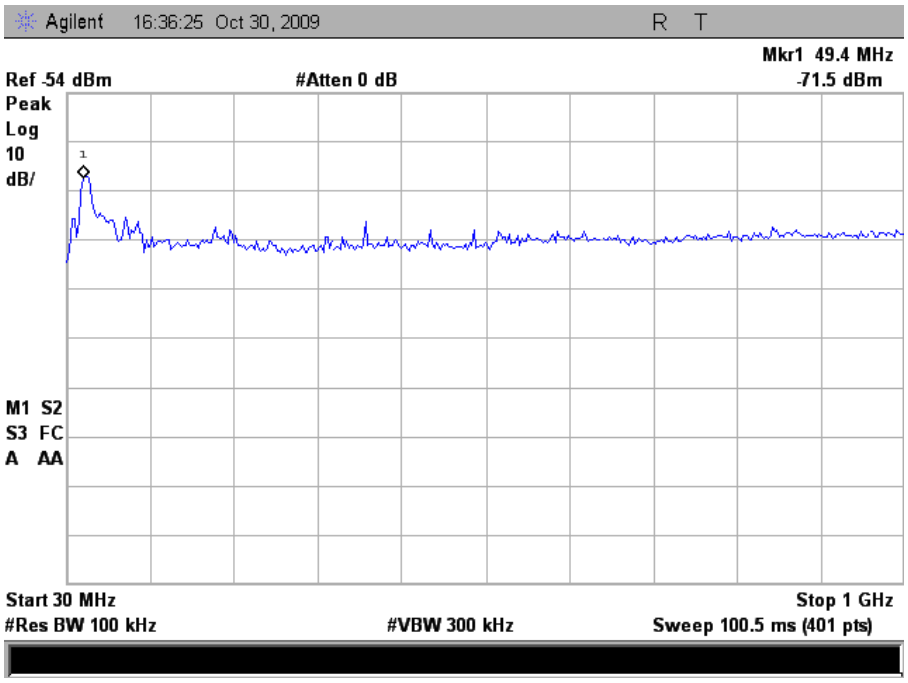


Plot 75. Radiated Spurious Emissions (30MHz – 1GHz), High Channel 5MHz

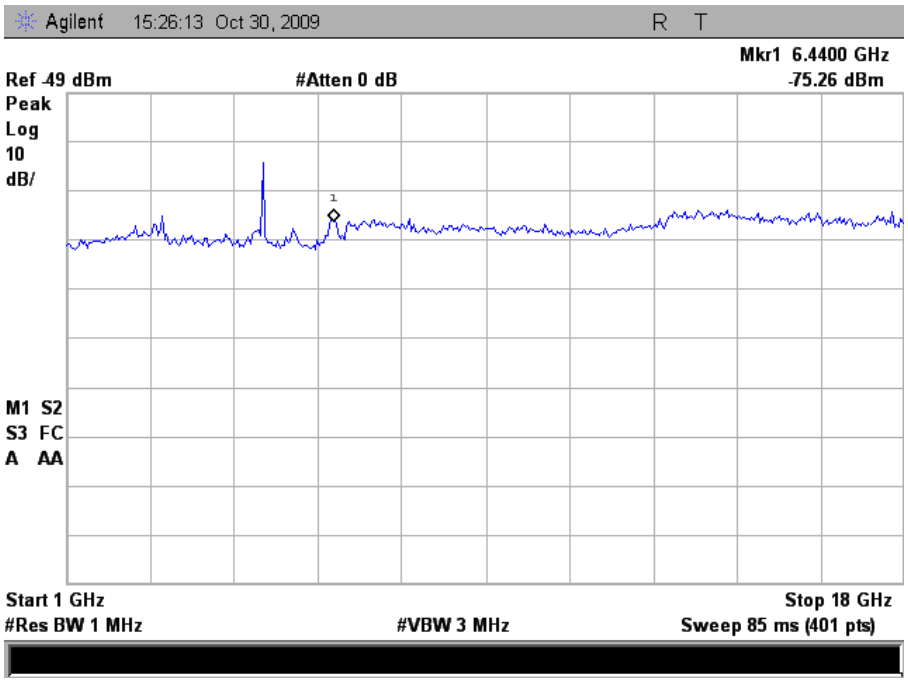


Plot 76. Radiated Spurious Emissions (1GHz – 18GHz), High Channel 5MHz

Radiated Spurious Emissions Test Results

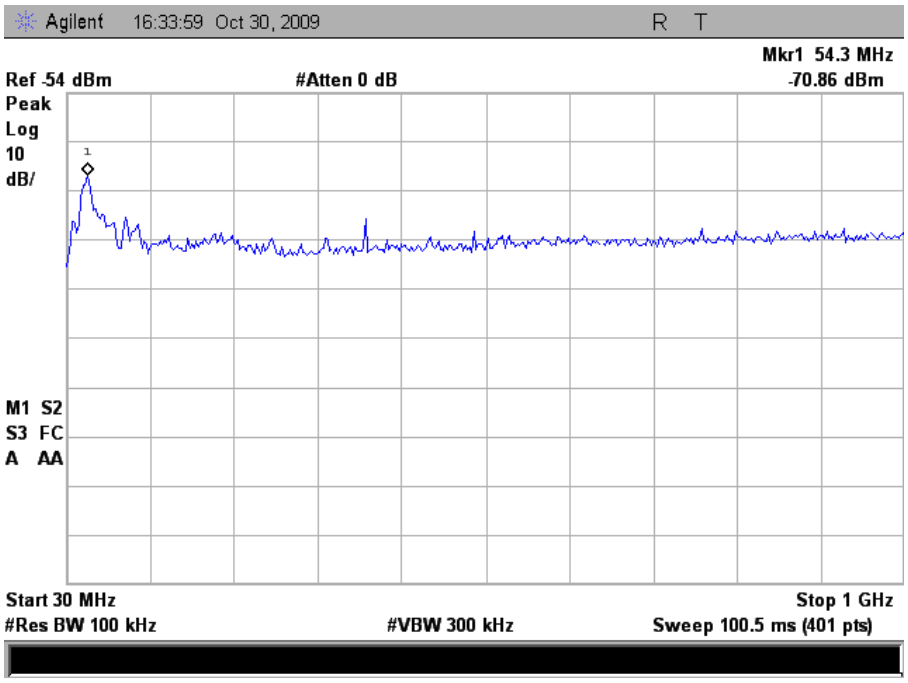


Plot 77. Radiated Spurious Emissions (30MHz – 1GHz), High Channel 10MHz

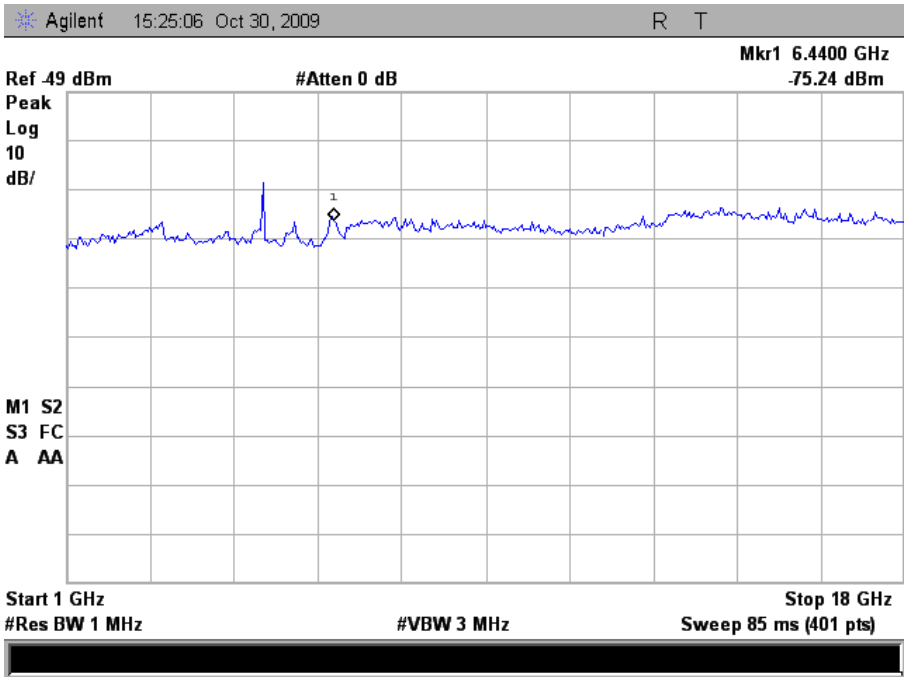


Plot 78. Radiated Spurious Emissions (1GHz – 18GHz), High Channel 10MHz

Radiated Spurious Emissions Test Results

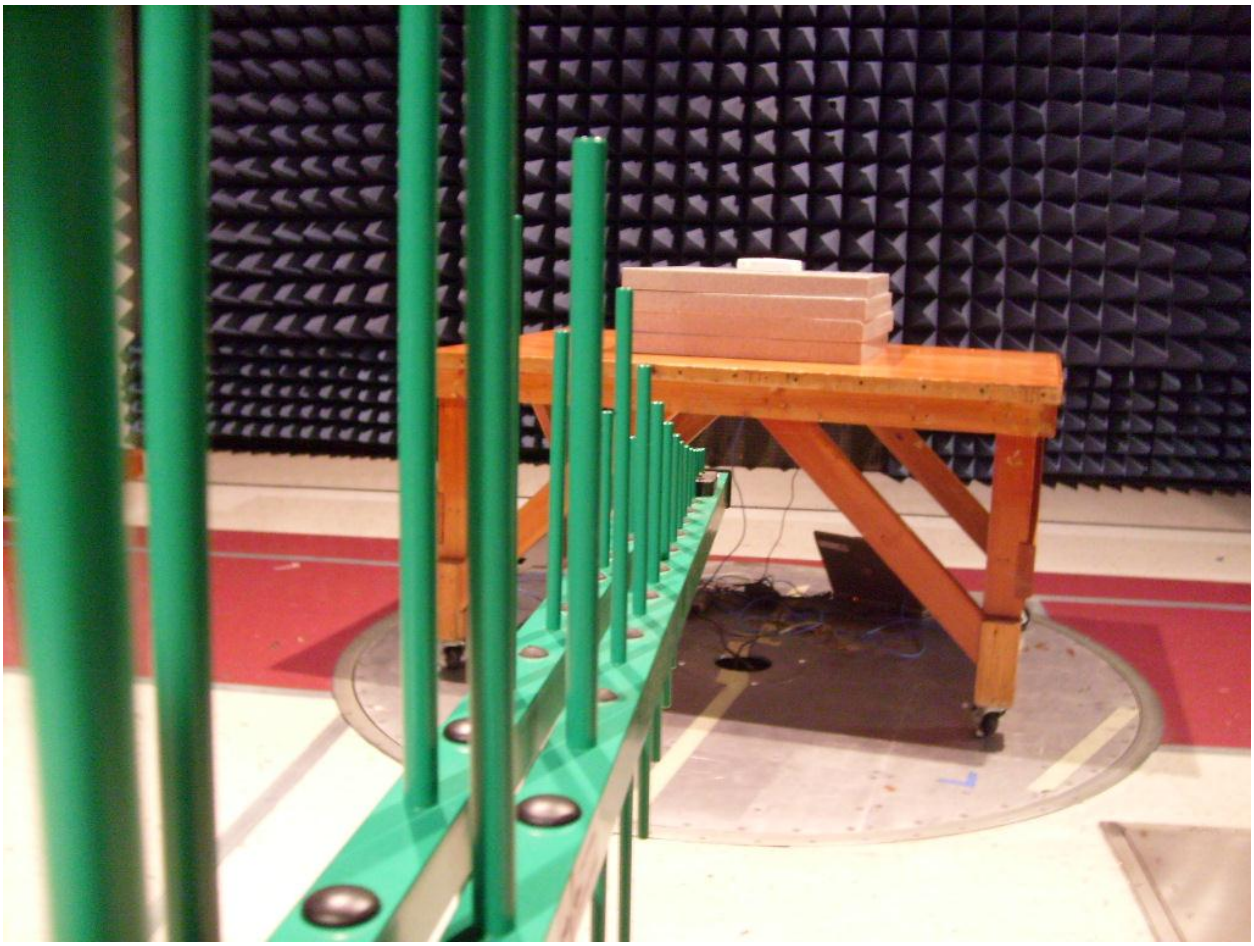


Plot 79. Radiated Spurious Emissions (30MHz – 1GHz), High Channel 20MHz



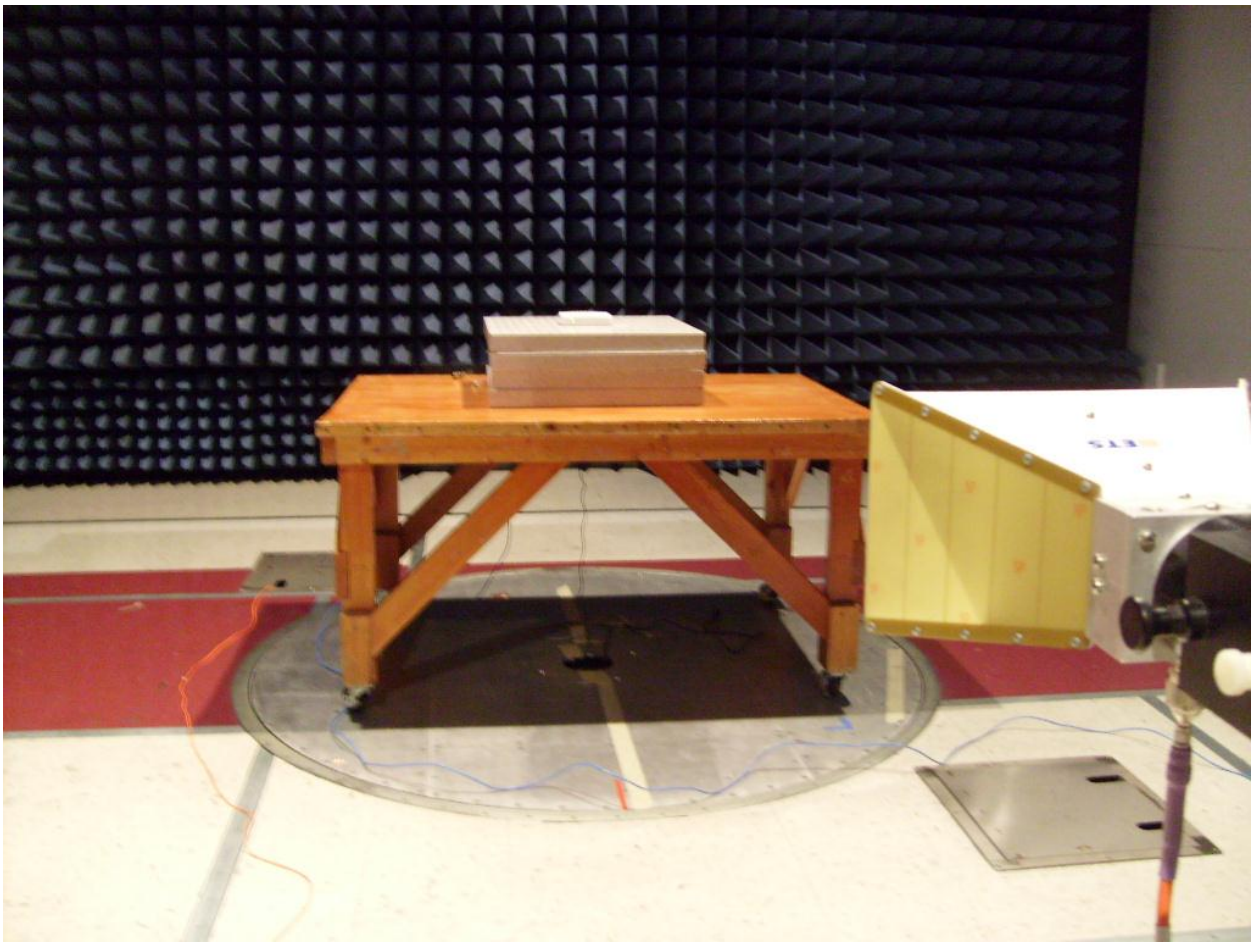
Plot 80. Radiated Spurious Emissions (1GHz – 18GHz), High Channel 20MHz

Radiated Spurious Emissions Test Setup Photographs



Photograph 2. Radiated Measurements Test Setup (30MHz-1GHz)

Radiated Spurious Emissions Test Setup Photographs



Photograph 3. Radiated Measurements Test Setup (1GHz-18GHz)

Electromagnetic Compatibility Frequency Stability Requirements

§2.1055 Frequency Stability

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

Test Procedures: The EUT was placed in the Environmental Chamber and support equipment was placed outside the chamber on a table. The EUT was set to transmit with CW at a particular channel. A 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 0 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: The EUT is compliant with Section 2.1055 and 90.213.

Test Engineer(s): Minh Ly

Test Date(s): 11/2/2009

Frequency Stability Test Results

(Low Channel)				
Reference 4945.046560	Voltage (AC)	Temperature (C)	Frequency (MHz)	PPM
	120	50	4945.140370	18.970
	120	40	4945.133380	17.557
	120	30	4945.087420	8.263
	120	20	4945.046560	0.000
	120	10	4945.012050	6.979
	120	0	4944.994210	10.586
	102	20	4945.051410	0.981
	138	20	4945.048740	0.441
(Mid Channel)				
Reference 4965.046080	Voltage (AC)	Temperature (C)	Frequency (MHz)	PPM
	120	50	4965.137780	18.469
	120	40	4965.136510	18.213
	120	30	4965.086370	8.115
	120	20	4965.046080	0.000
	120	10	4965.011670	6.930
	120	0	4964.995130	10.262
	102	20	4965.050600	0.910
	138	20	4965.052850	1.364
(High Channel)				
Reference 4985.044620	Voltage (AC)	Temperature (C)	Frequency (MHz)	PPM
	120	50	4985.137890	18.710
	120	40	4985.135680	18.267
	120	30	4985.082910	7.681
	120	20	4985.044620	0.000
	120	10	4985.009910	6.963
	120	0	4984.995910	9.771
	102	20	4985.048000	0.678
	138	20	4985.053700	1.821

Table 6. 5MHz and 10MHz Test Results

Note: EUT shuts down during testing at +50C. The anomaly is non-repeatable.

(Low Channel)				
Reference	Voltage (AC)	Temperature (C)	Frequency (MHz)	PPM
	120	50	4950.138410	18.727
	120	40	4950.132690	17.572
	120	30	4950.087340	8.410
	120	20	4950.045710	0.000
	120	10	4950.012240	6.762
4950.045710	120	0	4949.998370	9.564
	102	20	4950.049430	0.752
	138	20	4950.000000	9.234
(High Channel)				
Reference	Voltage (AC)	Temperature (C)	Frequency (MHz)	PPM
	120	50	4980.139014	17.382
	120	40	4980.138290	17.237
	120	30	4980.083450	6.225
	120	20	4980.052450	0.000
	120	10	4980.010870	8.349
4980.052450	120	0	4979.995900	11.355
	102	20	4980.048800	0.733
	138	20	4980.052740	0.058

Table 7. 20MHz Test Results

V. 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	
1S2485	BILOG ANTENNA	TESEQ	CBL6112D	3/20/2009	3/20/2010
1S2399	TURNTABLE CONTROLLER	SUNOL SCIENCE	SC99V	SEE NOTE	
1S2522	DIGITAL THERMO	FISHER SCIENTIFIC	11-661-7D	11/11/2009	11/11/2011
1S2482	5M CHAMBER	PANASHIELD	641431	10/16/2009	10/16/2010
1S2128	HARMONIC MIXER	HEWLETT PACKARD	11970A	11/22/2008	11/22/2010
1S2129	HARMONIC MIXER	HEWLETT PACKARD	11970K	11/22/2008	11/22/2010
1S2198	ANTENNA, HORN	EMCO	3115	09/03/2009	09/03/2010
1S2202	ANTENNA, HORN, 1 METER	EMCO	3116	04/10/2007	04/10/2010
1T4509	HIGH PASS FILTER	MICRO-TRONICS	HPM13146	SEE NOTE	
1S2460	ANALYZER, SPECTRUM	AGILENT	E4407B	04/14/2009	04/14/2010
1S2583	ANALYZER, SPECTRUM	AGILENT	E4447A	01/12/2009	01/12/2010
1S2034	COUPLER, DIRECTIONAL 1-20 GHZ	KRYTAR	101020020	SEE NOTE	

Table 8. Test Equipment List

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

VI. Certification & User's Manual Information

Certification Label & User's Manual Information

6.1 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.

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

6.2 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.

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.

