



**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

October 19, 2009

Fortress Technologies  
2 Technology Park Drive  
Westford, MA 01886

Dear John Pacheco,

Enclosed is the EMC Wireless test report for compliance testing of the Fortress Technologies, ES210 as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), FCC Part 15 Subpart C and Industry Canada RSS-210, Issue 7, June 2007 for Intentional Radiators.

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

Sincerely yours,  
MET LABORATORIES, INC.

Jennifer Sanchez  
Documentation Department

Reference: (\Fortress Technologies\EMC27866-FCC247)

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



## **Electromagnetic Compatibility Criteria Test Report**

for the

**Fortress Technologies  
ES210**

**Tested under**  
the FCC Certification Rules  
contained in  
Title 47 of the CFR, 15.247 Subpart C  
& Industry Canada RSS-210, Issue 7, June 2007  
for Intentional Radiators

**MET Report: EMC27866-FCC247**

October 19, 2009

**Prepared For:**

**Fortress Technologies  
2 Technology Park Drive  
Westford, MA 01886**

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



## Electromagnetic Compatibility Criteria Test Report

for the

**Fortress Technologies  
ES210**

**Tested under**  
the FCC Certification Rules  
contained in  
Title 47 of the CFR, 15.247 Subpart C  
& Industry Canada RSS-210, Issue 7, June 2007  
for Intentional Radiators

Dusmantha Tennakoon, Project Engineer  
Electromagnetic Compatibility Lab

Jennifer Sanchez  
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 the FCC Rules Part 15.247 and Industry Canada standard RSS-210, Issue 7, June 2007 under normal use and maintenance.

Shawn McMillen,  
Wireless Manager, Electromagnetic Compatibility Lab



## Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	October 15, 2009	Initial Issue.
1	October 19, 2009	Final Issue



## Table of Contents

<b>I.</b>	<b>Executive Summary .....</b>	<b>1</b>
	A. Purpose of Test .....	2
	B. Executive Summary .....	2
<b>II.</b>	<b>Equipment Configuration .....</b>	<b>3</b>
	A. Overview .....	4
	B. References .....	5
	C. Test Site .....	5
	D. Description of Test Sample .....	6
	E. Equipment Configuration .....	8
	F. Support Equipment .....	8
	G. Ports and Cabling Information .....	8
	H. Mode of Operation .....	8
	I. Method of Monitoring EUT Operation .....	8
	J. Modifications .....	8
	a) Modifications to EUT .....	8
	b) Modifications to Test Standard .....	8
	K. Disposition of EUT .....	8
<b>III.</b>	<b>Electromagnetic Compatibility Criteria for Intentional Radiators .....</b>	<b>9</b>
	§ 15.203 Antenna Requirement .....	10
	§ 15.247(b) Peak Power Output and RF Exposure .....	11
	§ 15.247(d) Radiated Spurious Emissions Requirements and Band Edge .....	15
	RSS-GEN Receiver Spurious .....	28
<b>IV.</b>	<b>Test Equipment .....</b>	<b>34</b>
<b>V.</b>	<b>Certification &amp; User's Manual Information .....</b>	<b>36</b>
	A. Certification Information .....	37
	B. Label and User's Manual Information .....	41
<b>VI.</b>	<b>ICES-003 Procedural &amp; Labeling Requirements .....</b>	<b>43</b>



## List of Tables

Table 1. Executive Summary of EMC Part 15.247 Compliance Testing .....	2
Table 2. EUT Summary Table.....	4
Table 3. References .....	5
Table 4. Equipment Configuration .....	8
Table 5. Ports and Cabling Information .....	8
Table 6. Output Power Requirements from §15.247 .....	11
Table 7. Restricted Bands of Operation.....	15
Table 8. Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a) .....	16
Table 9. Radiated Harmonic Emissions .....	17
Table 10. Test Equipment List .....	35

## List of Figures

Figure 1. Block Diagram of Test Configuration.....	7
--	---

## List of Plots

Plot 1. Peak Output Power, Low Channel .....	12
Plot 2. Peak Output Power, Mid Channel.....	12
Plot 3. Peak Output Power, High Channel .....	13
Plot 4. Low Channel Radiated Spurious Emissions, 30MHz-1GHz .....	18
Plot 5. Low Channel Radiated Spurious Emissions, 1-18GHz.....	19
Plot 6. Low Channel Radiated Spurious Emissions, 18-26.5GHz.....	19
Plot 7. Low Channel Radiated Spurious Emissions, 26.5-40GHz.....	20
Plot 8. Mid Channel Radiated Spurious Emissions, 30MHz-1GHz .....	21
Plot 9. Mid Channel Radiated Spurious Emissions, 1-18GHz .....	22
Plot 10. Mid Channel Radiated Spurious Emissions, 18-26.5GHz .....	22
Plot 11. Mid Channel Radiated Spurious Emissions, 26.5-40GHz .....	23
Plot 12. High Channel Radiated Spurious Emissions, 30MHz-1GHz.....	24
Plot 13. High Channel Radiated Spurious Emissions, 1-18GHz.....	25
Plot 14. High Channel Radiated Spurious Emissions, 18-26.5GHz.....	25
Plot 15. High Channel Radiated Spurious Emissions, 26.5-40GHz.....	26
Plot 16. Receiver Spurious Emission, 30MHz – 1GHz.....	29
Plot 17. Receiver Spurious Emission, 1 GHz – 3GHz .....	29
Plot 18. Receiver Spurious Emission, 3GHz – 6GHz .....	30
Plot 19. Receiver Spurious Emission, 6GHz – 9GHz .....	30
Plot 20. Receiver Spurious Emission, 9GHz – 12GHz .....	31
Plot 21. Receiver Spurious Emission, 12GHz – 15GHz .....	31
Plot 22. Receiver Spurious Emission, 15GHz – 18GHz .....	32

## List of Photographs

Photograph 1. Fortress Technologies ES210.....	6
Photograph 2. Radiated Spurious Emission, Test Setup.....	27
Photograph 3. Receiver Spurious Emissions, Test Setup .....	33



## List of Terms and Abbreviations

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



# **I. Executive Summary**





## A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Fortress Technologies ES210, with the requirements of FCC Part §15.247 and Industry Canada RSS-210. 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 ES210. Fortress Technologies should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the ES210, has been **permanently** discontinued.

## B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part §15.247 and Industry Canada RSS-210, in accordance with Fortress Technologies, quote number 1FOR2809R4. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference	IC Reference	Description	Compliance
Title 47 of the CFR, Part 15 §15.203	N/A	Antenna Requirement	Compliant
Title 47 of the CFR, Part 15 §15.207(a)	RSS-210(7.2.2)	Conducted Emission Voltage	N/A – Refer to FCC ID: SWX-SR71
Title 47 of the CFR, Part 15 §15.247(a)(1)	RSS-210(A8.1)	Occupied Bandwidth	N/A – Refer to FCC ID: SWX-SR71
Title 47 of the CFR, Part 15 §15.247(b)	RSS-210(A8.4)	RF Output Power	Compliant
Title 47 of the CFR, Part 15 §15.209, §15.247(d)	RSS-210(A8.5)	Radiated Spurious Emissions	Compliant
Title 47 of the CFR, Part 15 §15.205	RSS-210(A8.5)	Emissions at Restricted Band	Compliant
Title 47 of the CFR, Part 15 §15.209, §15.247(d)	RSS-210(A8.5)	Conducted Spurious Emissions	N/A – Refer to FCC ID: SWX-SR71
Title 47 of the CFR, Part 15; §15.247(e)	RSS-210(A8.3)	Power Spectral Density	N/A – Refer to FCC ID: SWX-SR71
Title 47 of the CFR, Part 15 §15.247(i)	RSS-Gen(5.5)	Maximum Permissible Exposure	Compliant
N/A	RSS-Gen(4.8)	Receiver Spurious Emissions	Compliant

**Table 1. Executive Summary of EMC Part 15.247 Compliance Testing**



## II. Equipment Configuration

## A. Overview

MET Laboratories, Inc. was contracted by Fortress Technologies to perform testing on the ES210, under Fortress Technologies' quote number 1FOR2809R4.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Fortress Technologies, ES210.

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

<b>Model(s) Tested:</b>	ES210		
<b>Model(s) Covered:</b>	ES210		
<b>EUT Specifications:</b>	Primary Power: 120/240VAC, 60/30mA		
	FCC ID: WYK-ES210 IC ID: 8190A-ES210		
	Type of Modulations:	OFDM	
	Equipment Code:	DTS	
	Peak RF Output Power:	23.23dBm (0.210W)	
	EUT Frequency Ranges:	5745-5825MHz	
<b>Analysis:</b>	The results obtained relate only to the item(s) tested.		
<b>Environmental Test Conditions:</b>	Temperature: 15-35° C		
	Relative Humidity: 30-60%		
	Barometric Pressure: 860-1060 mbar		
<b>Evaluated by:</b>	Dusmantha Tennakoon		
<b>Report Date(s):</b>	October 19, 2009		

**Table 2. EUT Summary Table**

**B. References**

<b>CFR 47, Part 15, Subpart C</b>	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: General Rules and Regulations, Allocation, Assignment, and Use of Radio Frequencies
<b>RSS-210, Issue 7, June 2007</b>	Low-power License-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment
<b>ANSI C63.4:2003</b>	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
<b>ANSI/NCSL Z540-1-1994</b>	Calibration Laboratories and Measuring and Test Equipment - General Requirements
<b>ANSI/ISO/IEC 17025:2000</b>	General Requirements for the Competence of Testing and Calibration Laboratories

**Table 3. References****C. Test Site**

All testing was performed at MET Laboratories, Inc., 914 W. Patapsco Ave, Baltimore, MD 21230. 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 3 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

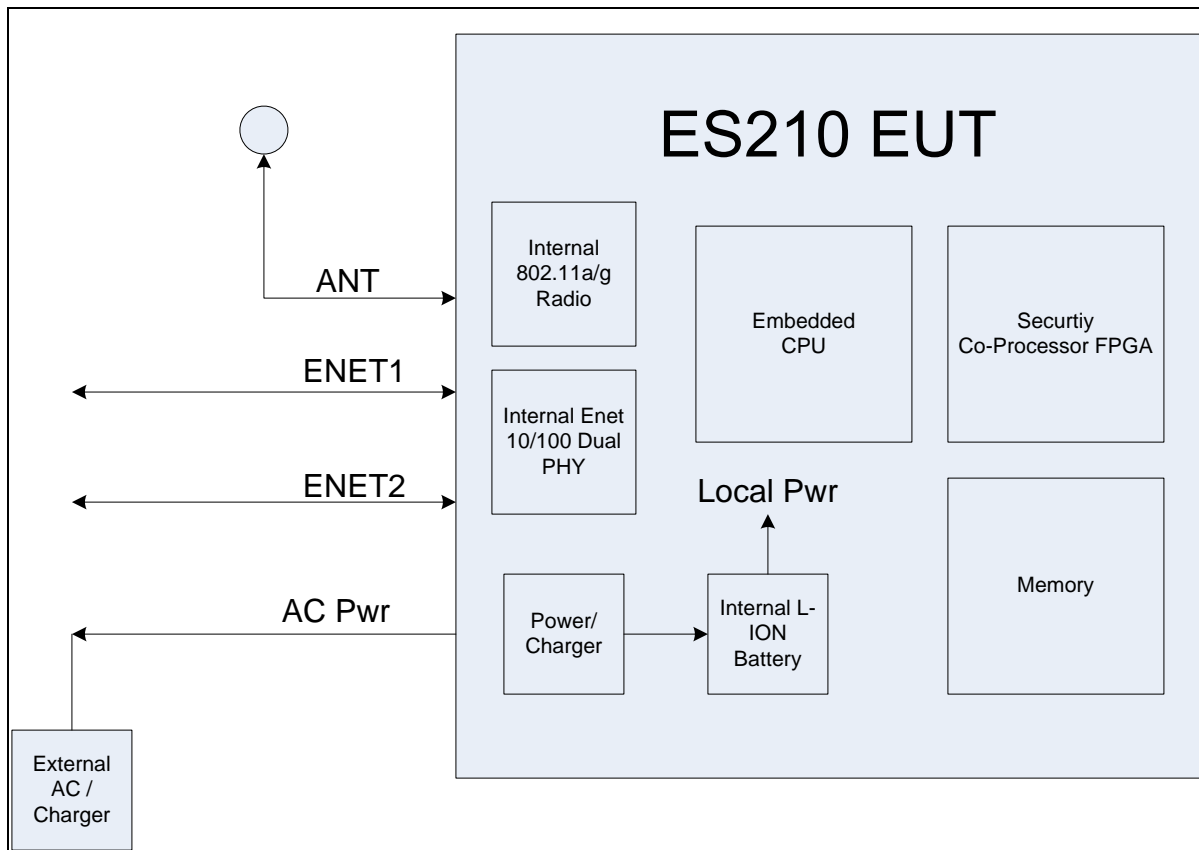
## D. Description of Test Sample

The Fortress Technologies ES210, is a single radio access point/bridge. It embeds a COTS high power radio and two Ethernet ports in a ruggedized enclosure. The radio operates in accordance to the 802.11a, 802.11b, and 802.11g standards.

The ES210 is intended to provide outdoor connectivity in a secure manner both wired and wirelessly. It can operate with either AC power or by a battery.



Photograph 1. Fortress Technologies ES210



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

## E. Equipment Configuration

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

Ref. ID	Name / Description	Model Number	Serial Number
1	Fortress Secure Access Point	ES210	109160002

Table 4. Equipment Configuration

## F. Support Equipment

The EUT did not require any support equipment for operation or monitoring.

## G. Ports and Cabling Information

Port name on EUT	Cable Description or reason for no cable	Qty.	Termination Box ID & Port ID
Enet 1	Wired Ethernet 10/100	1	
Enet 2	Wired Ethernet 10/100	1	
Ant	Antenna	1	Spectrum Analyzer
AC Pwr	2-wire	1	External AC Charger

Table 5. Ports and Cabling Information

## H. Mode of Operation

Testing modes were entered using ART, the Atheros Radio Test tool. This is a standard tool provide by Atheros for directly manipulating and configuring their chips during testing and manufacturing.

## I. Method of Monitoring EUT Operation

A Spectrum Analyzer was use to monitor the EUT's transmitter channel and power output.

## J. Modifications

- a) **Modifications to EUT**  
No modifications were made to the EUT.
- b) **Modifications to Test Standard**  
No modifications were made to the test standard.

## K. Disposition of EUT

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



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





## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.203 Antenna Requirement

**Test Requirement:**

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

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

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

**Results:**

The EUT as tested is compliant the criteria of §15.203. The Unit is professionally installed.

**Test Engineer(s):**

Dusmantha Tennakoon

**Test Date(s):**

10/08/09

Gain	Type	Model	Manufacturer
5dBi	Omni	WAE-5AG	Air Live

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(b) Peak Power Output and RF Exposure

**Test Requirements:** §15.247(b): The maximum peak output power of the intentional radiator shall not exceed the following:

Digital Transmission Systems (MHz)	Output Limit (Watts)
902-928	1.000
2400-2483.5	1.000
5725- 5850	1.000

**Table 6. Output Power Requirements from §15.247**

§15.247(c): if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in the Table 6, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400 – 2483.5 MHz band may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Fixed, point-to-point operation excludes the use of point-to-multipoint systems, Omni-directional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

**Test Procedure:** The transmitter was connected to a calibrated spectrum analyzer. The EUT was measured at the low, mid and high channels of each band at the maximum power level.

**Test Results:** The EUT was compliant with the Peak Power Output limits of §15.247(b).

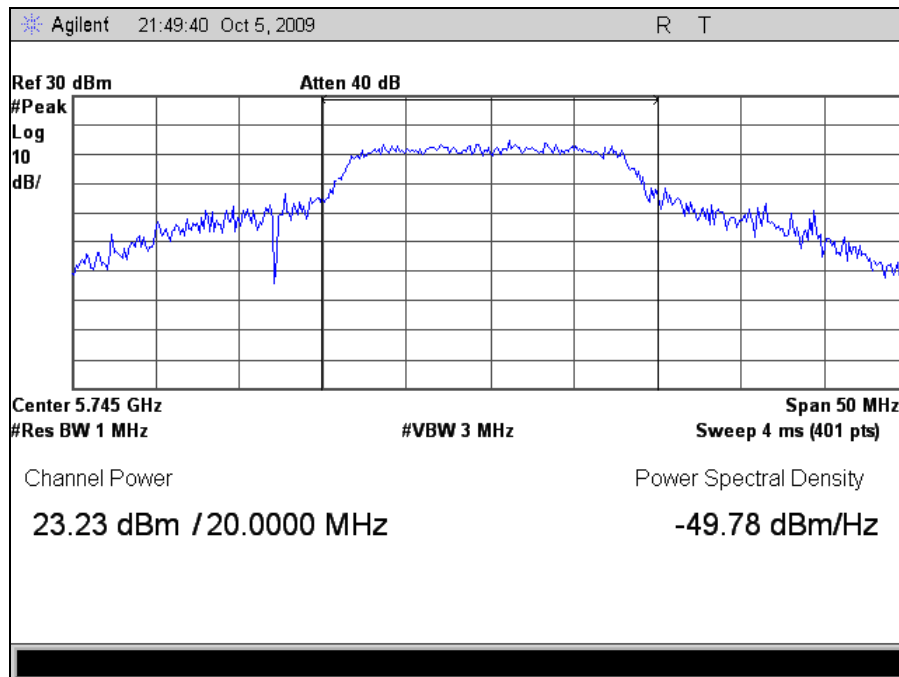
Peak Conducted Output Power		
Carrier Channel	Frequency (MHz)	Measured Peak Output Power dBm
Low	5745	23.23
Mid	5785	22.63
High	5825	22.38

**Test Engineer(s):** Dusmantha Tennakoon

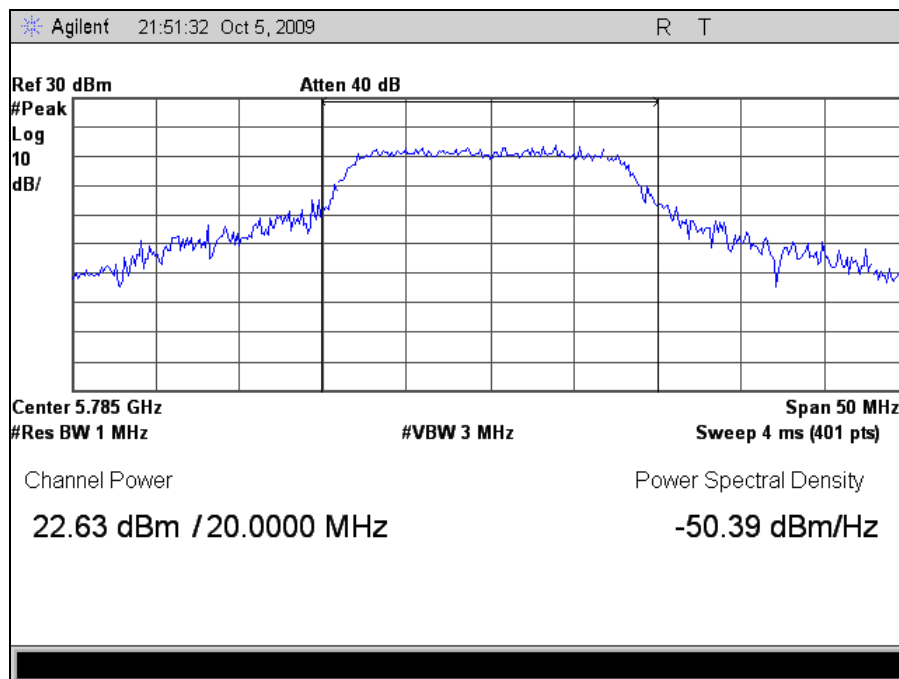
**Test Date(s):** 10/05/09



## Peak Power Output Test Results



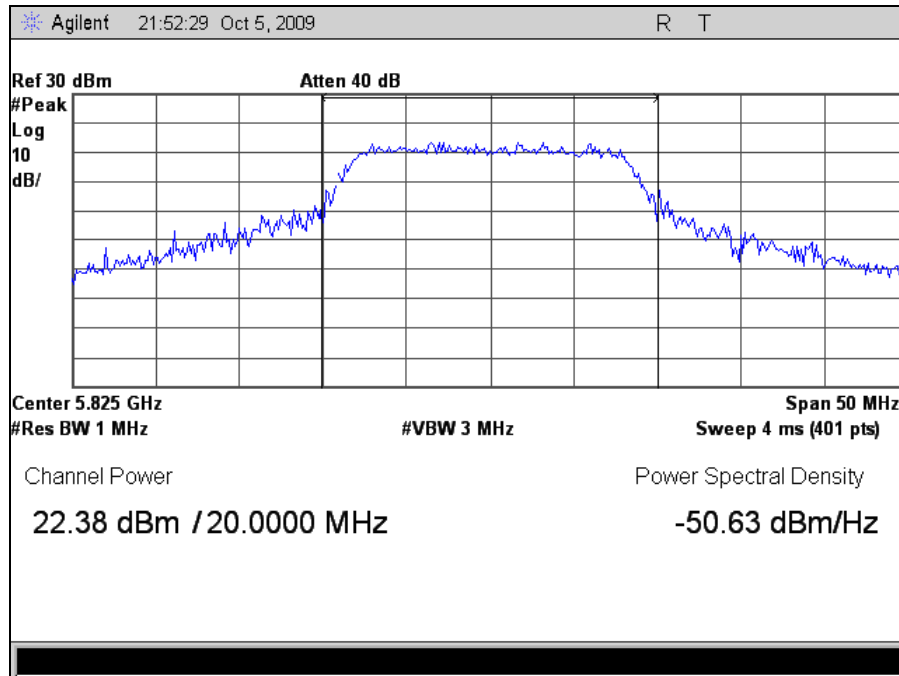
Plot 1. Peak Output Power, Low Channel



Plot 2. Peak Output Power, Mid Channel



## Peak Power Output Test Results



Plot 3. Peak Output Power, High Channel



## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(b) RF Exposure

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

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

MPE Limit Calculation: EUT's operating frequencies @ 5745-5825 MHz; highest conducted power = 23.23dBm (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm<sup>2</sup> or 10 W/m<sup>2</sup>**

EUT maximum antenna gain = 5 dBi.

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

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

where, S = Power Density ( mW/cm<sup>2</sup>)  
P = Power Input to antenna (210.3778mW)  
G = Antenna Gain (3.16 numeric)

$$S = (210.38 * 3.16 / 4 * 3.14 * 20.0^2) = (665.2732 / 5024) = \mathbf{0.13mW/cm^2} \text{ @ 20cm separation}$$

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(d) Radiated Spurious Emissions Requirements and Band Edge

**Test Requirements:** §15.247(d); §15.205: Emissions outside the frequency band.

**§15.247(d):** In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).

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

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

**Table 7. Restricted Bands of Operation**

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490 – 0.510 MHz.

<sup>2</sup> Above 38.6

**Test Requirement(s):** § 15.209 (a): Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in Table 8.

Frequency (MHz)	§ 15.209(a), Radiated Emission Limits (dBµV) @ 3m
30 - 88	40.00
88 - 216	43.50
216 - 960	46.00
Above 960	54.00

**Table 8. Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a)**

**Test Procedures:** Measurements were performed on the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Only noise floor was measured above 18 GHz.

**Test Results:** The EUT was completed with the Radiated Spurious Emission limits of § 15.247(d).

**Test Engineer(s):** Dusmantha Tennakoon

**Test Date(s):** 10/05/09 & 10/06/09



## Harmonic Emissions Requirements – Radiated

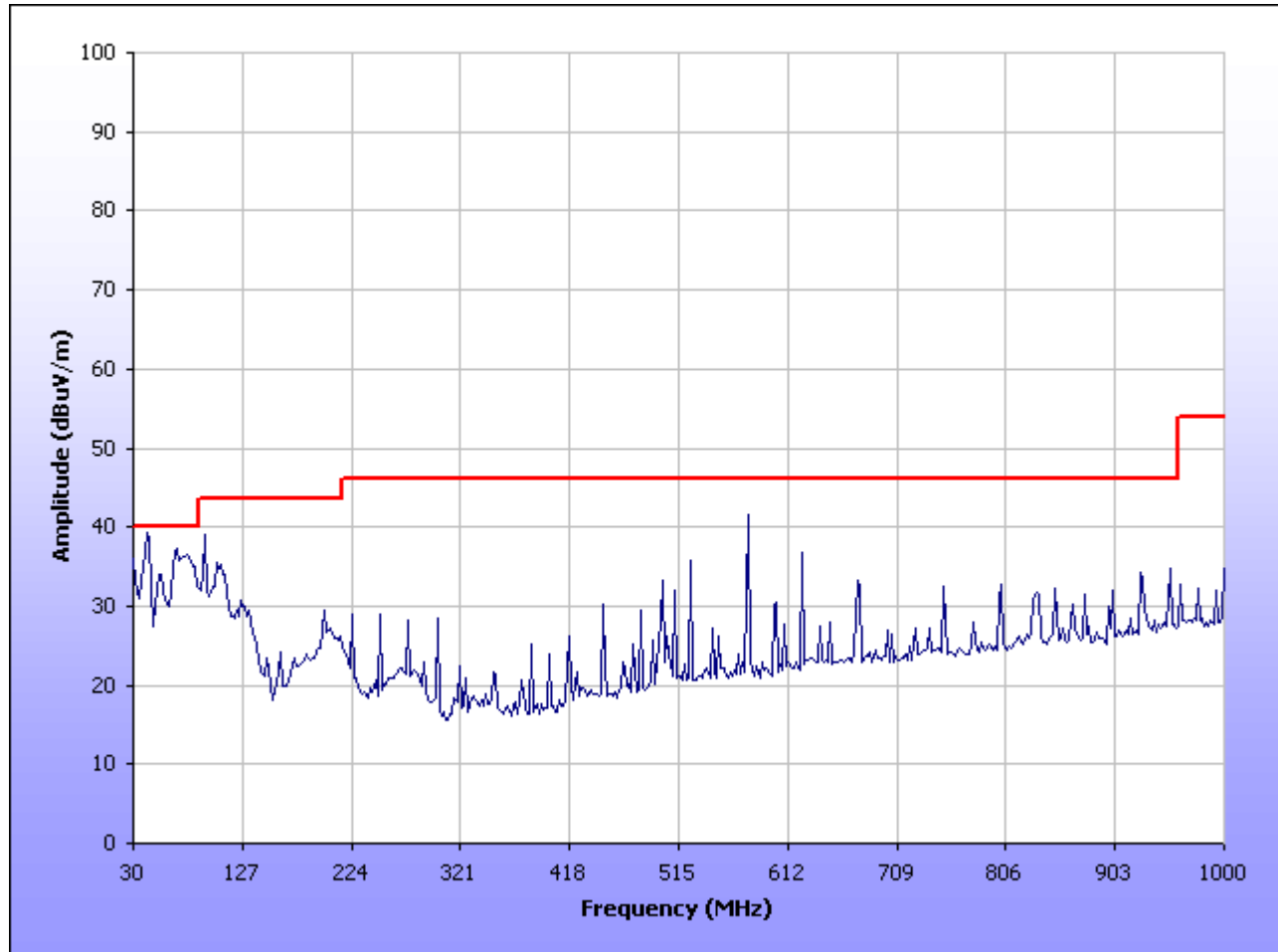
Channel (MHz)	Measured Frequency (MHz)	Measured corrected amplitude (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Remark
5745	11490	44.55	54	-9.45	Avg
	11490	57.64	74	-16.36	Peak
	17235	55.64	74	-18.36	Peak
5785	11570	44.66	54	-9.34	Avg
	11570	55.88	74	-18.12	Peak
	17355	54.78	74	-19.22	Peak
5825	11650	42.13	54	-11.87	Avg
	11650	54.78	74	-19.22	Peak
	17475	56.83	74	-17.17	Peak

**Table 9. Radiated Harmonic Emissions**

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



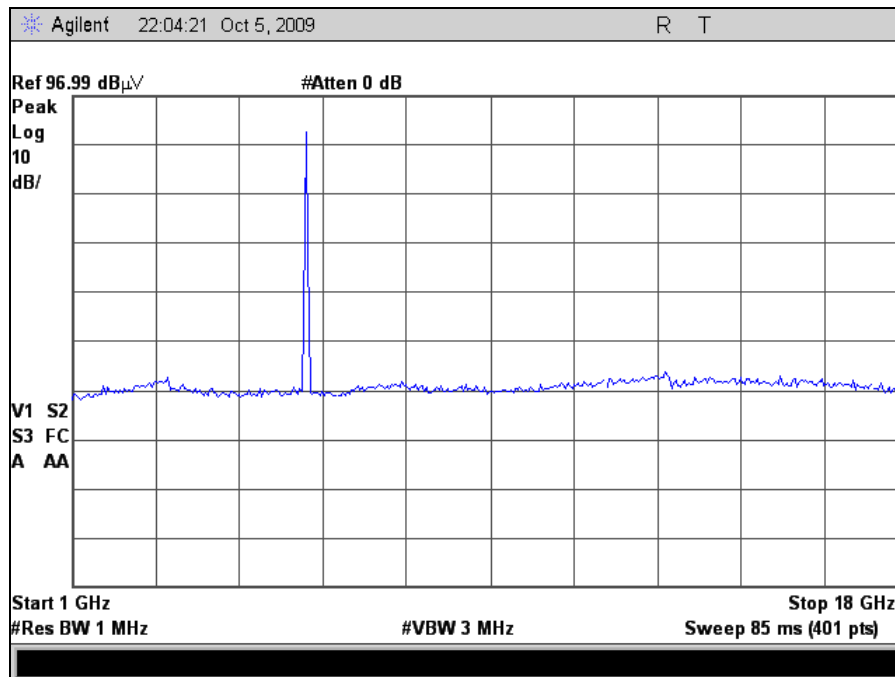
## Radiated Spurious Emissions Test Results



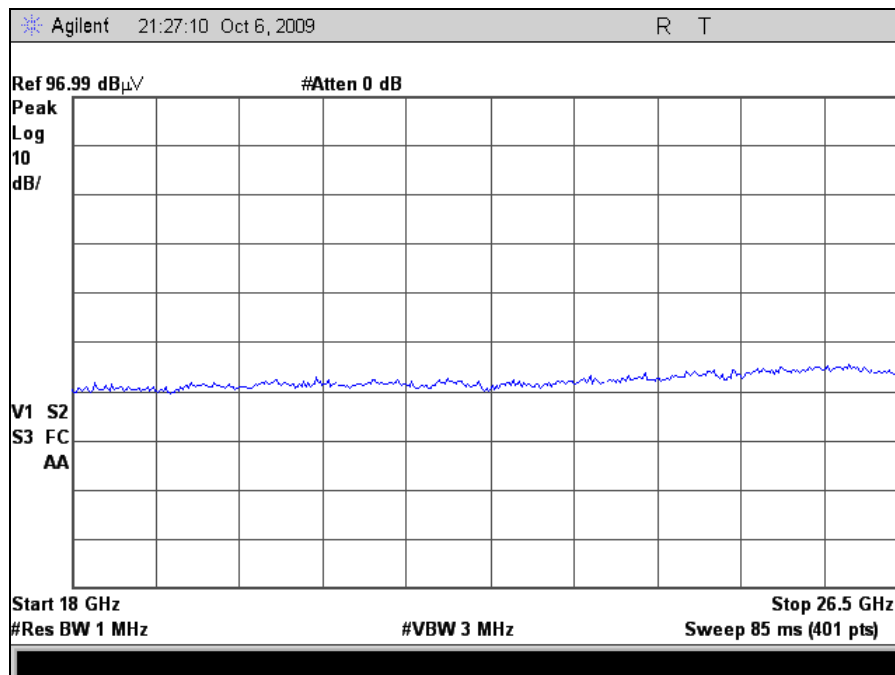
Plot 4. Low Channel Radiated Spurious Emissions, 30MHz-1GHz



## Radiated Spurious Emissions Test Results



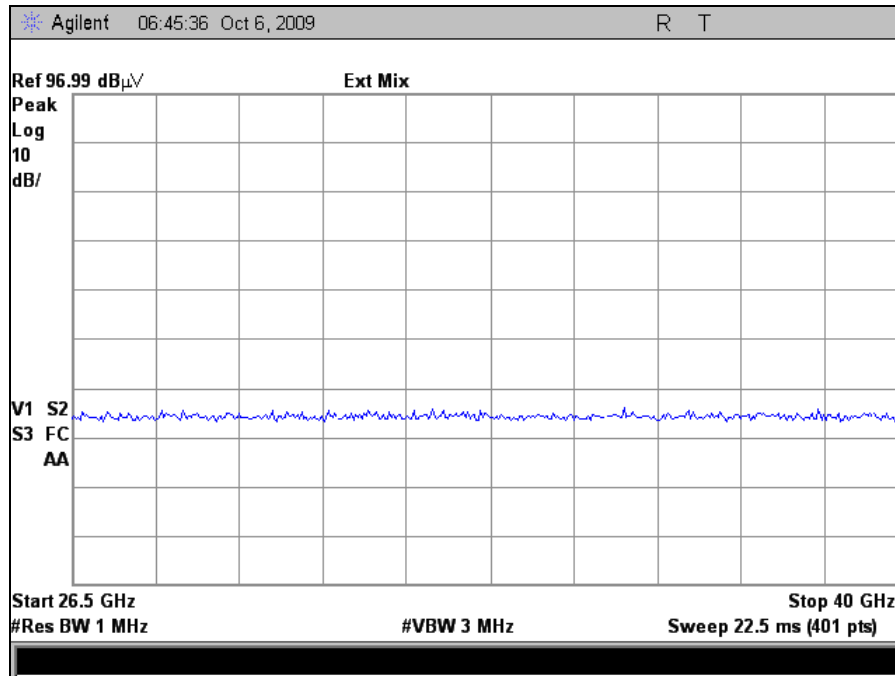
Plot 5. Low Channel Radiated Spurious Emissions, 1-18GHz



Plot 6. Low Channel Radiated Spurious Emissions, 18-26.5GHz



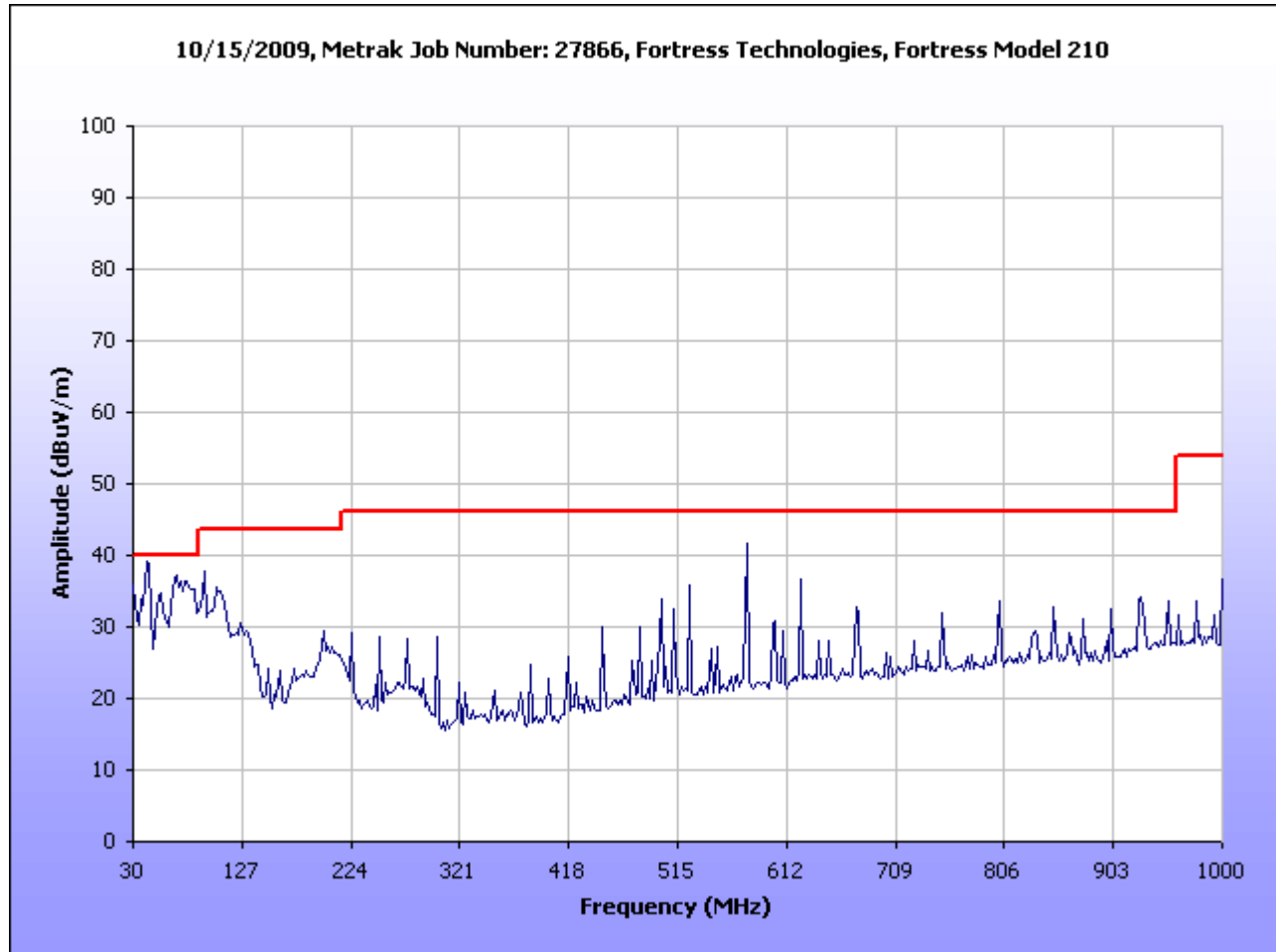
## Radiated Spurious Emissions Test Results



Plot 7. Low Channel Radiated Spurious Emissions, 26.5-40GHz

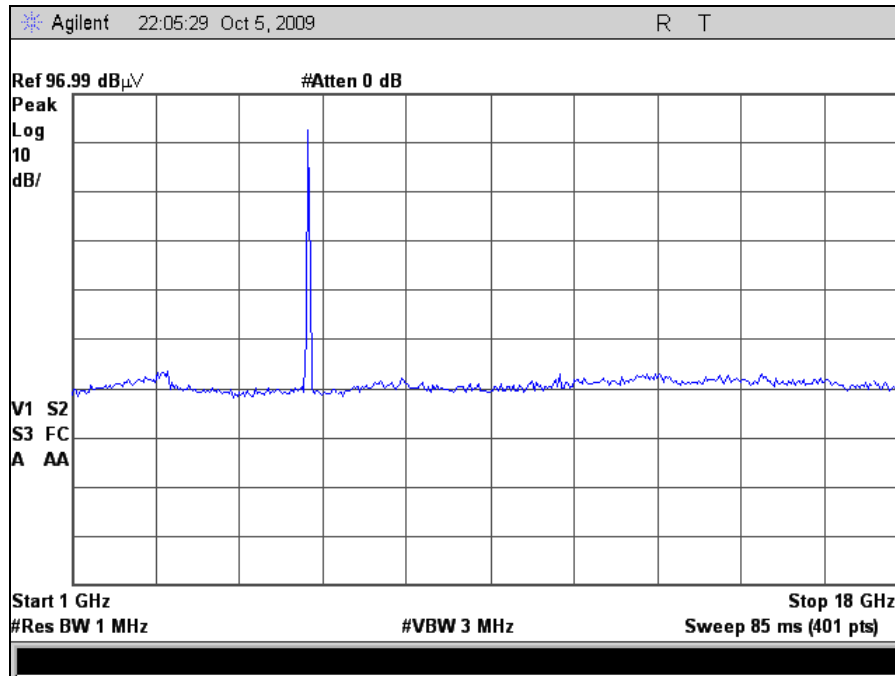


## Radiated Spurious Emissions Test Results

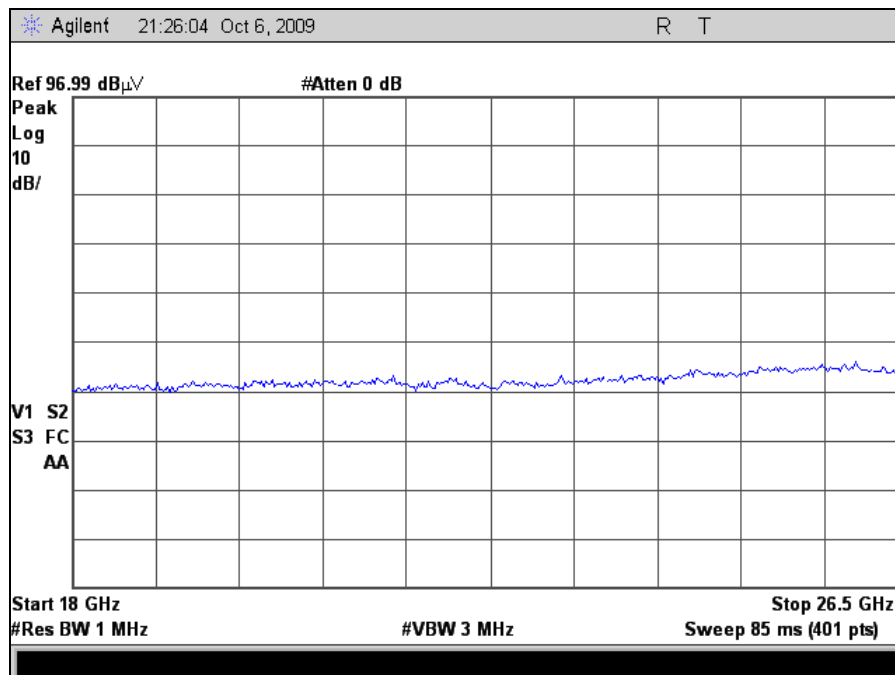


Plot 8. Mid Channel Radiated Spurious Emissions, 30MHz-1GHz

## Radiated Spurious Emissions Test Results



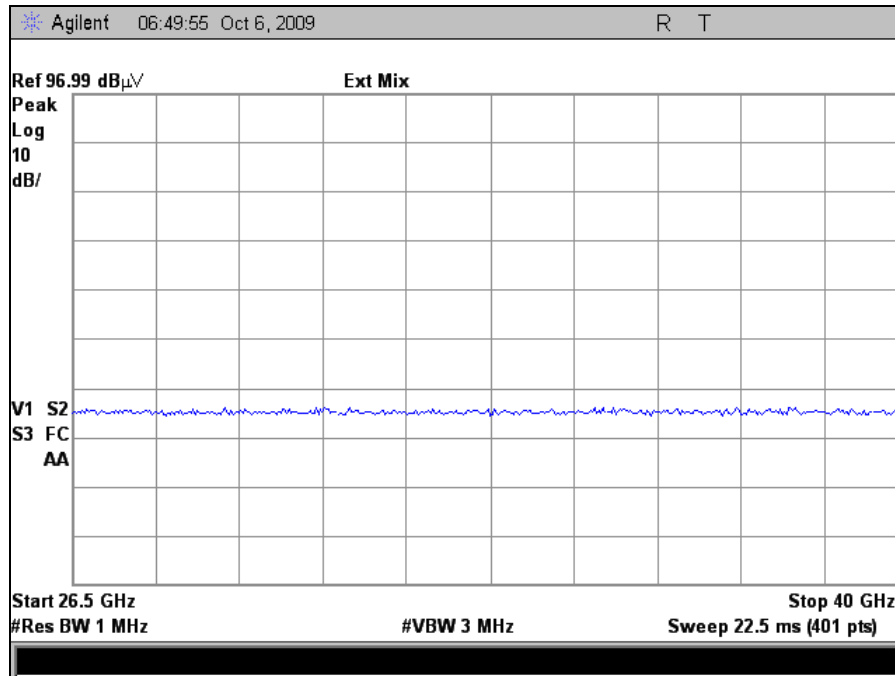
Plot 9. Mid Channel Radiated Spurious Emissions, 1-18GHz



Plot 10. Mid Channel Radiated Spurious Emissions, 18-26.5GHz



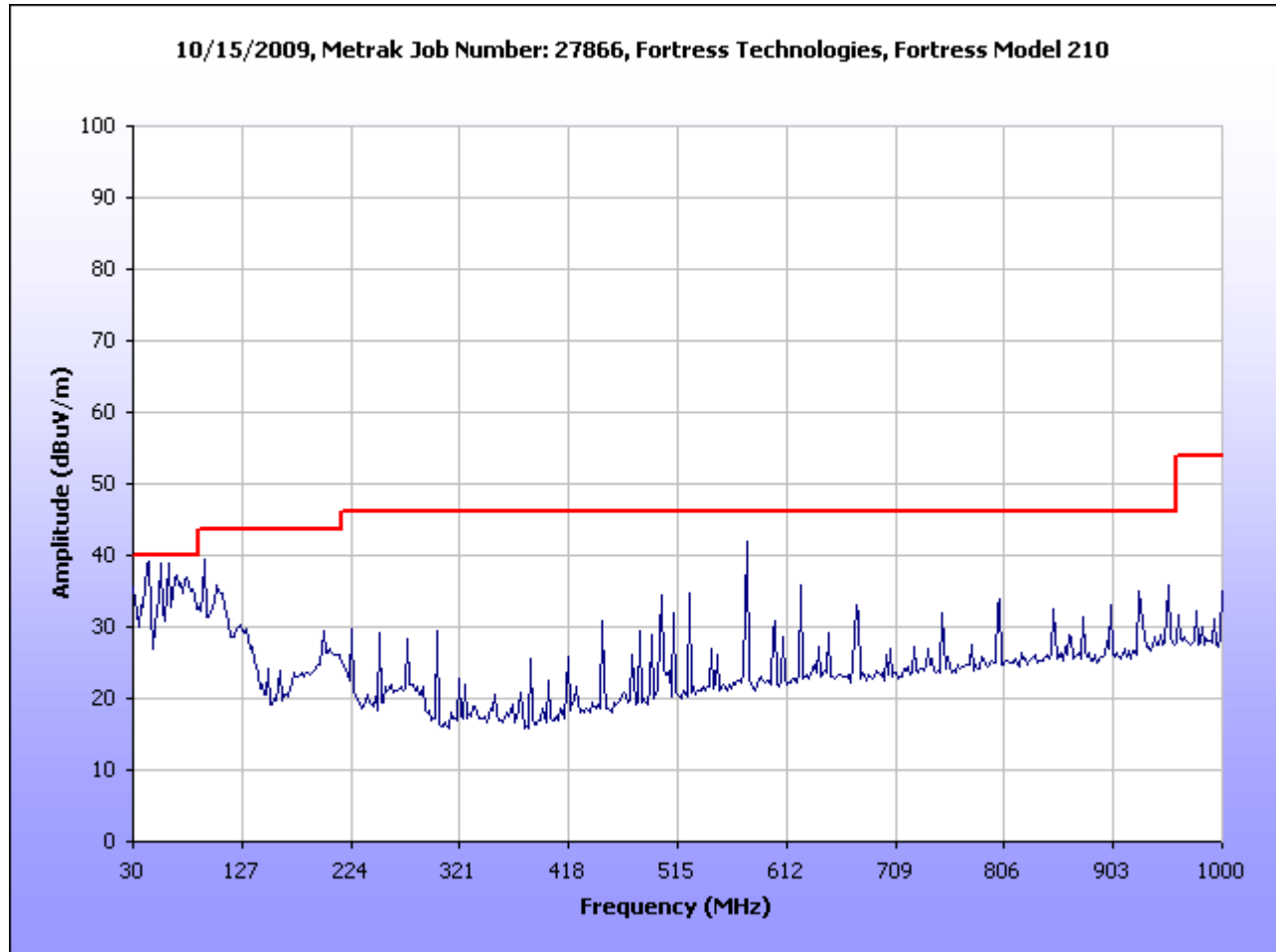
## Radiated Spurious Emissions Test Results



Plot 11. Mid Channel Radiated Spurious Emissions, 26.5-40GHz

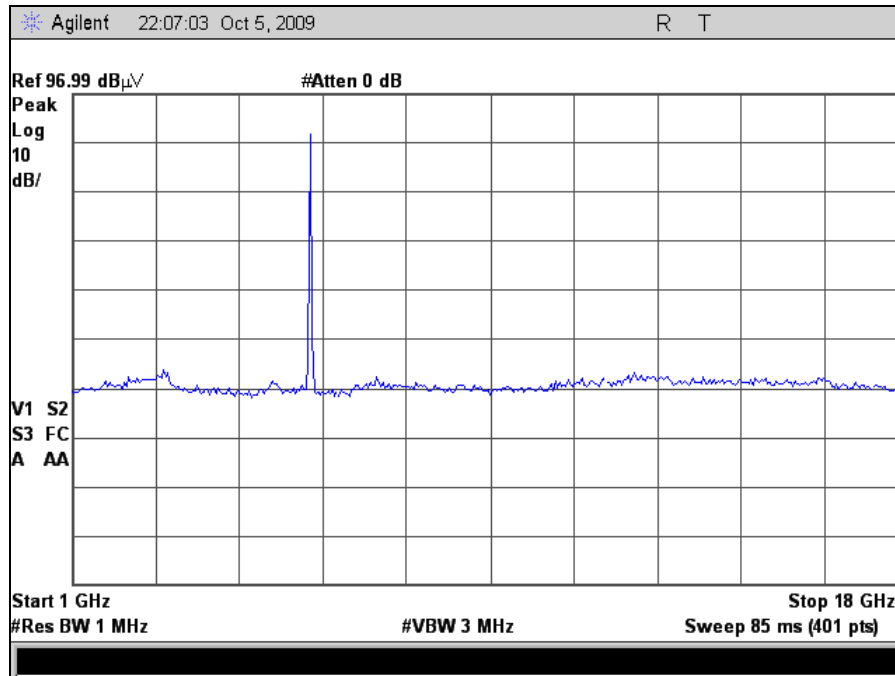


## Radiated Spurious Emissions Test Results

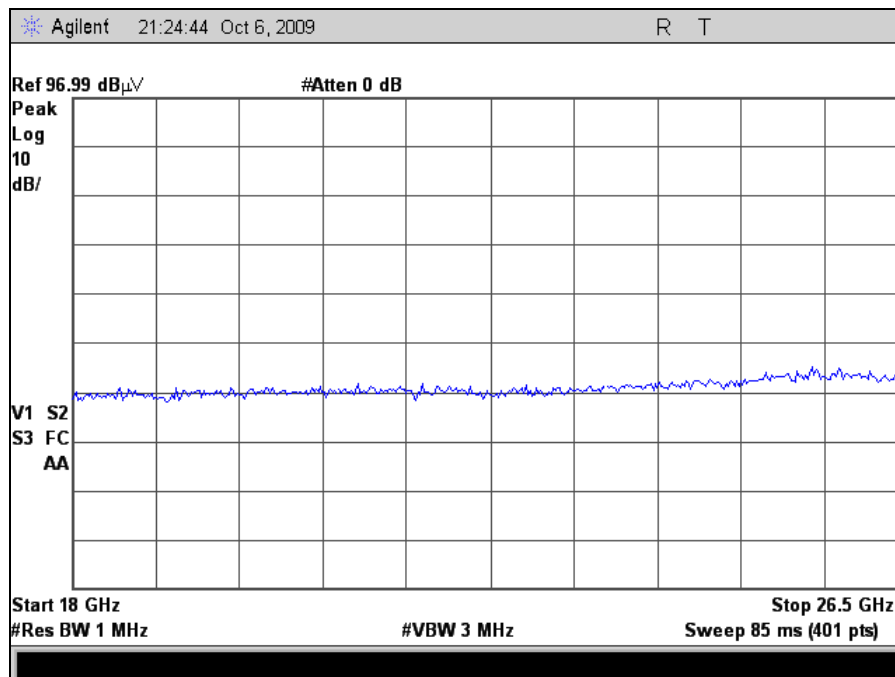


Plot 12. High Channel Radiated Spurious Emissions, 30MHz-1GHz

## Radiated Spurious Emissions Test Results



Plot 13. High Channel Radiated Spurious Emissions, 1-18GHz

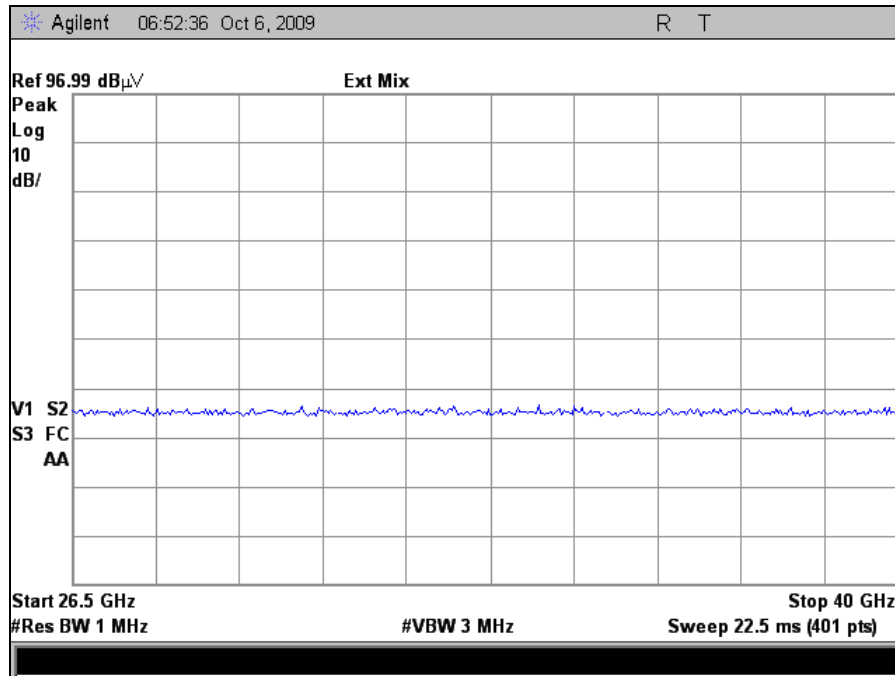


Plot 14. High Channel Radiated Spurious Emissions, 18-26.5GHz



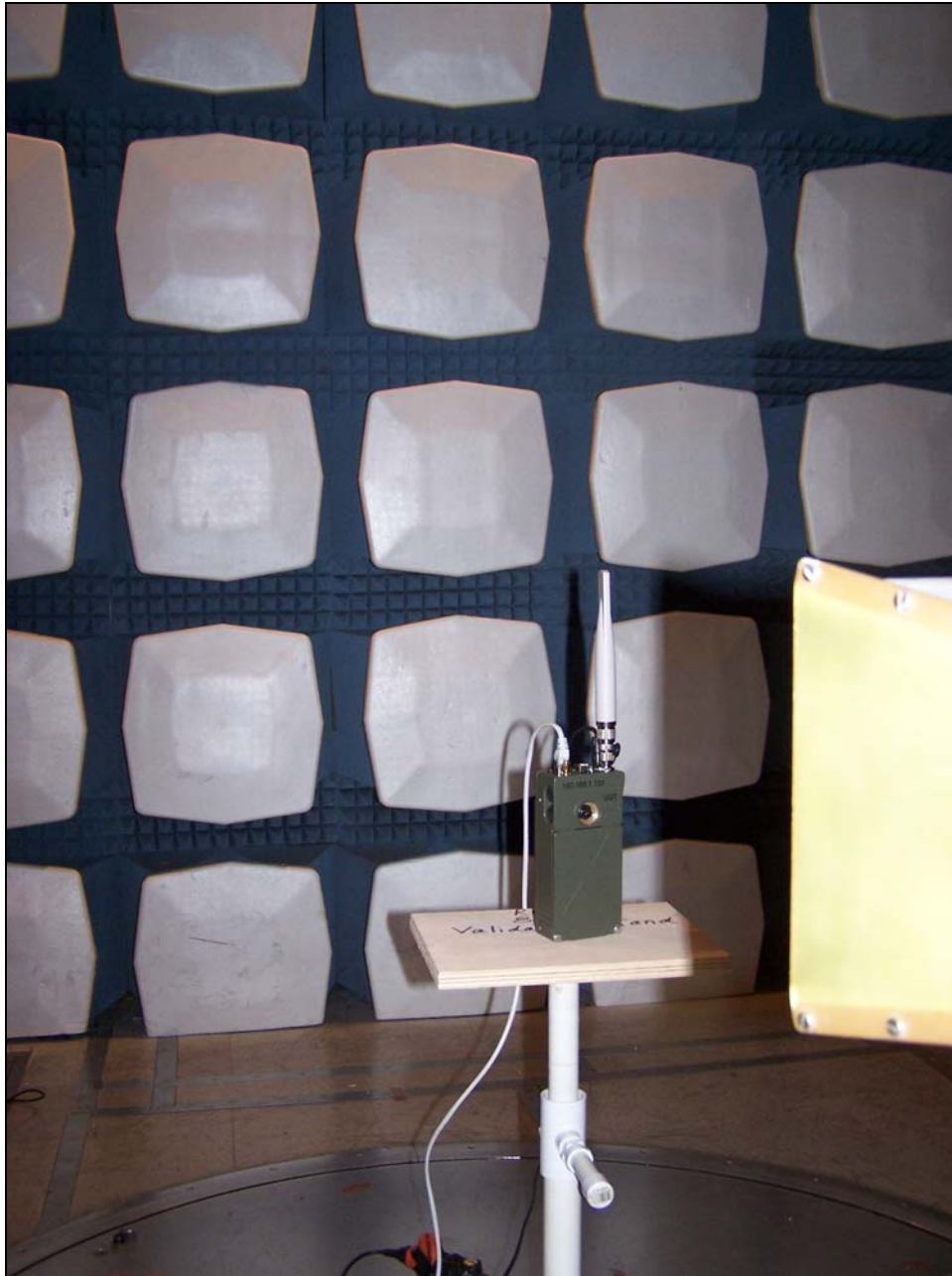


## Radiated Spurious Emissions Test Results



Plot 15. High Channel Radiated Spurious Emissions, 26.5-40GHz

## Radiated Spurious Emissions Test Setup Photographs



**Photograph 2. Radiated Spurious Emission, Test Setup**



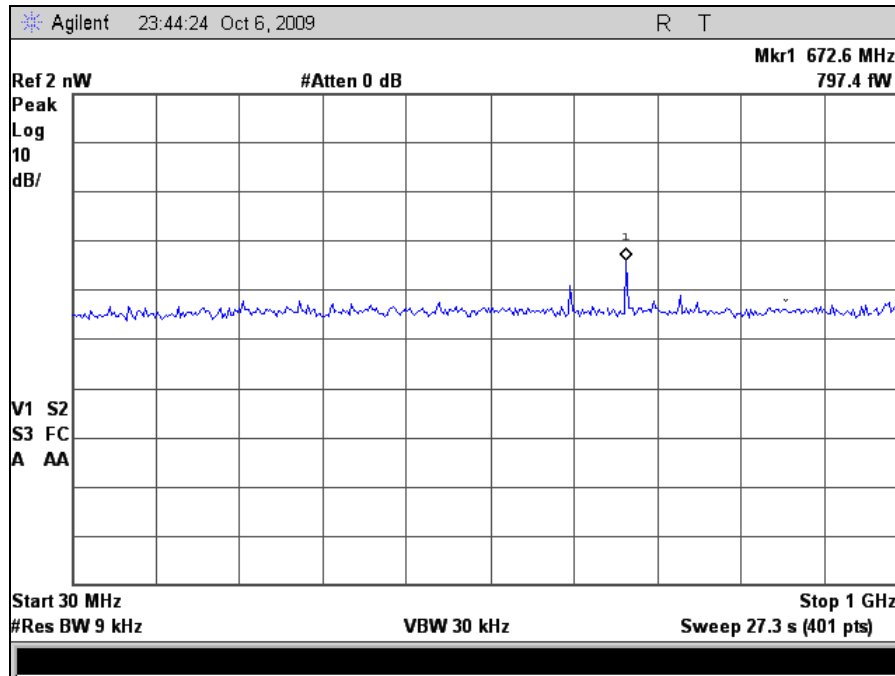
## Electromagnetic Compatibility Criteria for Intentional Radiators

### RSS-GEN Receiver Spurious

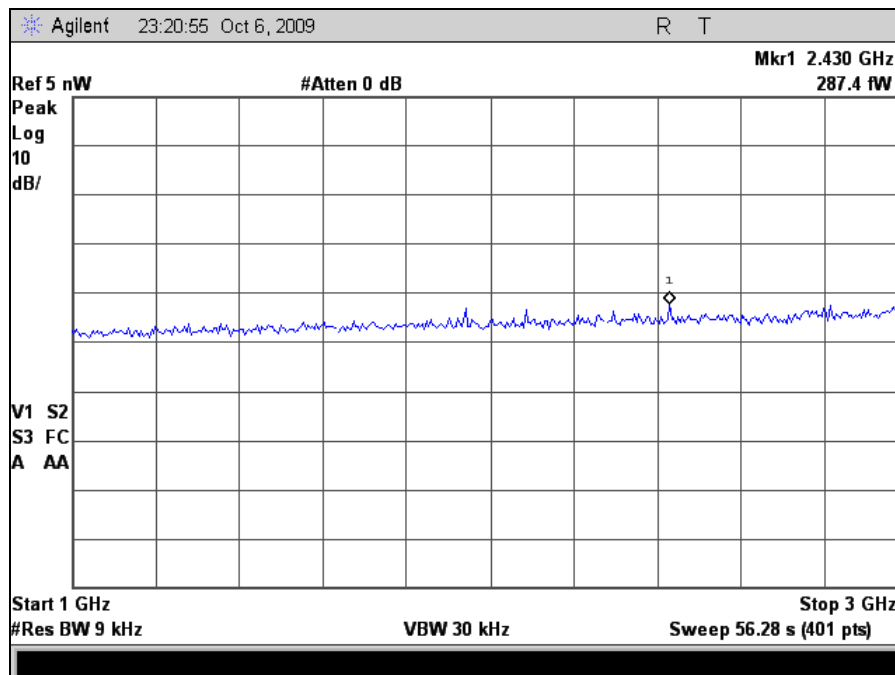
<b>Test Requirement:</b>	<p>If the device has a detachable antenna of known antenna impedance, then the antenna conducted method is permitted in lieu of a radiated measurement.</p> <p>If a conducted measurement is made, no spurious output signals appearing at the antenna terminals shall exceed 2 nanowatts per any 4 kHz spurious frequency in the band 30 – 1000 MHz, or 5 nanowatts above 1 GHz.</p>
<b>Test Procedure:</b>	<p>The EUT was directly connected to a spectrum analyzer. Testing was performed when the EUT was receiving on channel 5785 MHz.</p>
<b>Results:</b>	<p>The EUT as tested is compliant with the requirements of RSS-GEN.</p>
<b>Test Engineer(s):</b>	<p>Dusmantha Tennakoon</p>
<b>Test Date(s):</b>	<p>10/06/09</p>



## Receiver Spurious Emissions Test Results

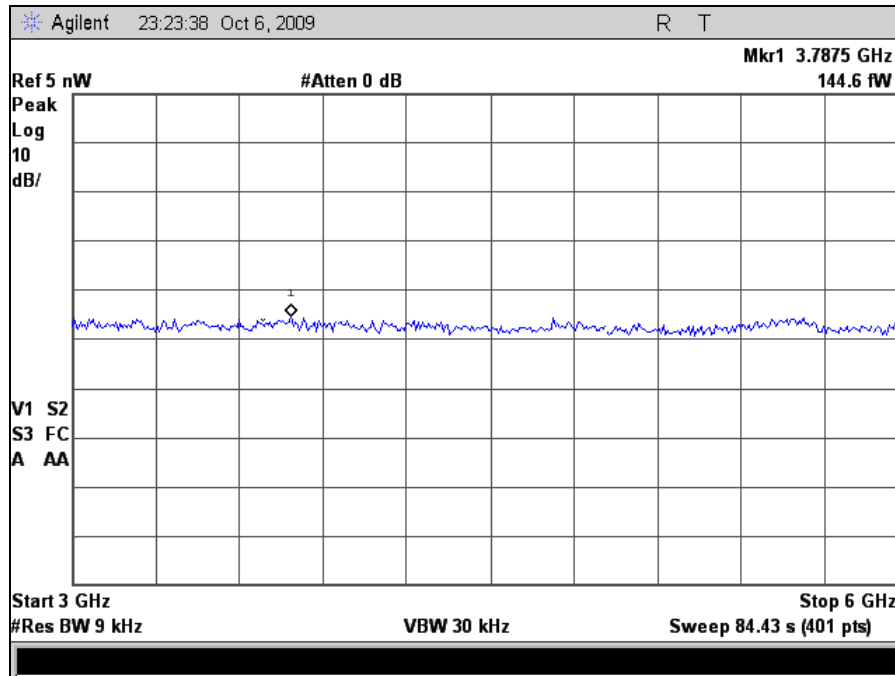


Plot 16. Receiver Spurious Emission, 30MHz – 1GHz

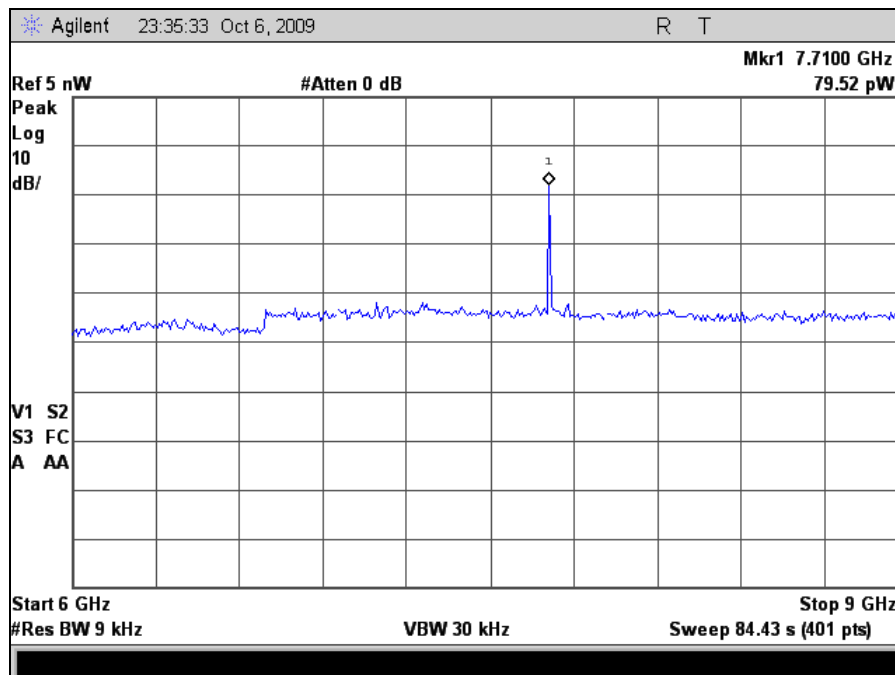


Plot 17. Receiver Spurious Emission, 1 GHz – 3GHz

## Receiver Spurious Emissions Test Results



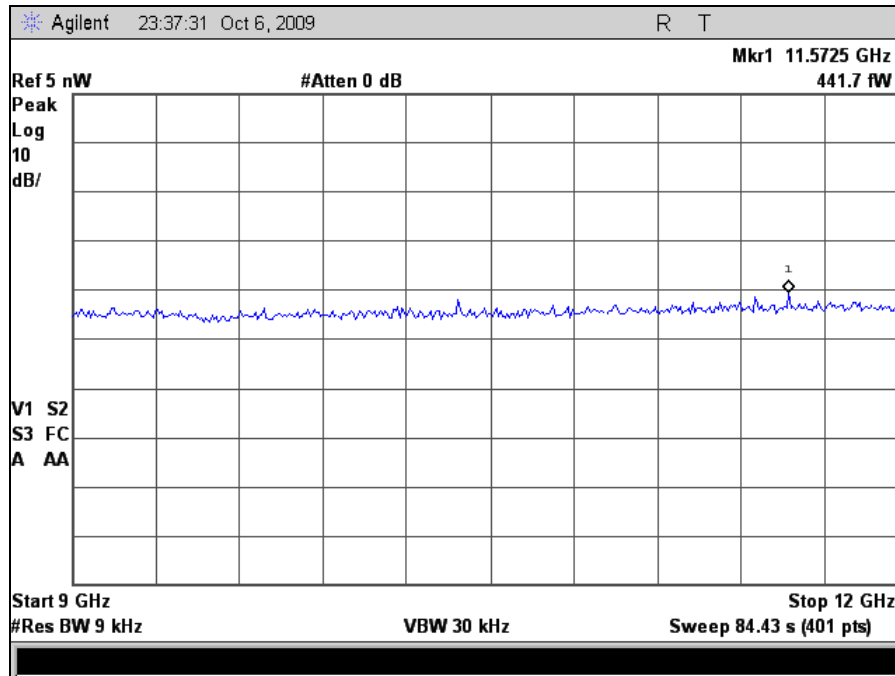
Plot 18. Receiver Spurious Emission, 3GHz – 6GHz



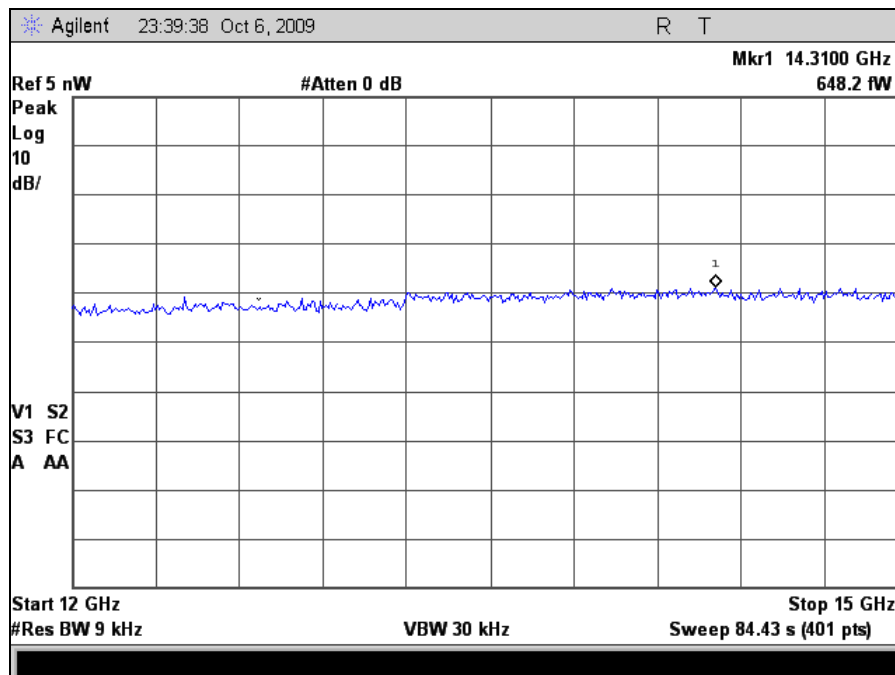
Plot 19. Receiver Spurious Emission, 6GHz – 9GHz



## Receiver Spurious Emissions Test Results



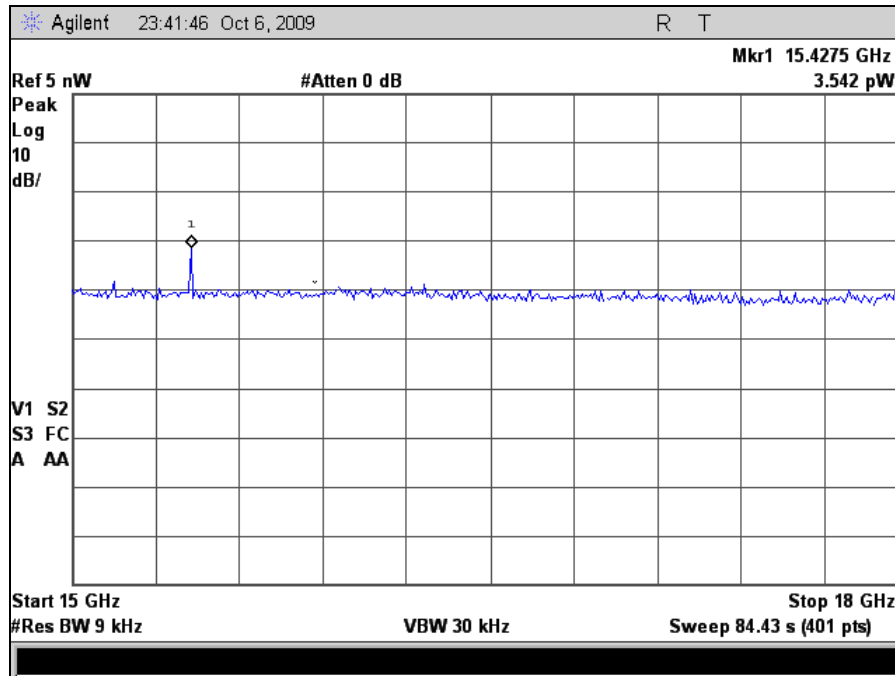
Plot 20. Receiver Spurious Emission, 9GHz – 12GHz



Plot 21. Receiver Spurious Emission, 12GHz – 15GHz

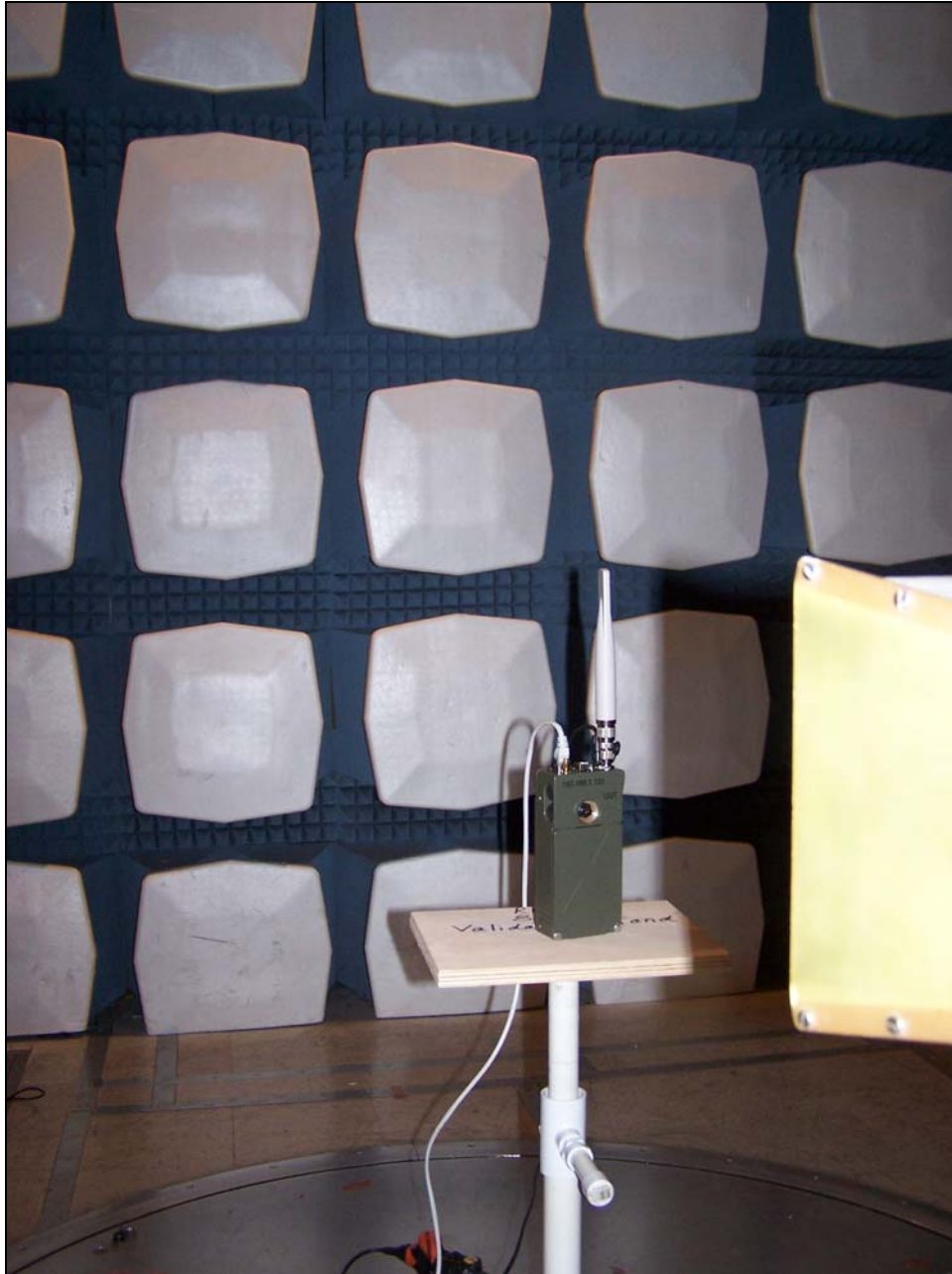


## Receiver Spurious Emissions Test Results



Plot 22. Receiver Spurious Emission, 15GHz – 18GHz

## Receiver Spurious Emissions Test Setup Photograph



**Photograph 3. Receiver Spurious Emissions, Test Setup**





## IV. Test Equipment



## Test Equipment

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

MET #	Equipment	Manufacturer	Model#	Cal Date	Cal Due
1T4300	SEMI-ANECHOIC CHAMBER # 1	EMC TEST SYSTEMS	NONE	08/24/2007	08/24/2010
1T2665	HORN ANTENNA	EMCO	3115	07/06/2009	07/06/2010
1T4442	PRE-AMPLIFIER, MICROWAVE	MITEQ	AFS42-01001800-30-10P	SEE NOTE	
1T4621	ESA-E SERIES SPECTRUM ANALYZER	AGILENT	E4402B	03/20/2009	03/20/2010
1T4592	RF FILTER KIT	VARIOUS	N/A	SEE NOTE	

**Table 10. Test Equipment List**

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



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



## Certification & User's Manual Information

### A. Certification Information

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

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

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

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

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

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

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



## Certification & User's Manual Information

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

### § 2.901 Basis and Purpose

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

### § 2.907 Certification.

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

---

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



## Certification & User's Manual Information

### § 2.948 Description of measurement facilities.

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



## Certification & User's Manual Information

### Label and User's Manual Information

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

#### § 15.19 Labeling requirements.

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

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

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

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

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

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

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

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

#### § 15.21 Information to user.

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





## Verification & User's Manual Information

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

### § 15.105 Information to the user.

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

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

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

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

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



## ICES-003 Procedural & Labeling Requirements

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

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

### Procedural Requirements:

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

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

### Labeling Requirements:

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

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

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

---

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



Fortress Technologies  
ES210

Electromagnetic Compatibility  
End of Report  
CFR Title 47, Part 15.247; & Industry Canada RSS-210

---

# End of Report