



**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

March 6, 2008

Rajant Corporation  
400 E. King Street  
Malvern, PA 19355

Dear Brian Hassick,

Enclosed is the EMC test report for compliance testing of the Rajant Corporation, XLE as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-03 ed.), Part 15, Subpart C.

This test report is for a Class II Permissive Change to the XLE Unit to add additional antennas.

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: (\\Rajant Corporation\\EMC22952-FCC247)

DOC EMC702 9/13/2007

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Rajant Corporation  
XLE

CFR Title 47, Part 15, Subpart C

## **Electromagnetic Compatibility Test Report**

for the

**Rajant Corporation  
XLE**

**Verified under**  
the FCC Certification Rules  
contained in  
Title 47 of the CFR, Part 15.247, Subpart C  
for Intentional Radiators

**MET Report: EMC22952-FCC247**

March 6, 2008

**Prepared For:**

**Rajant Corporation  
400 E. King Street  
Malvern, PA 19355**

**Prepared By:**  
**MET Laboratories, Inc.**  
914 W. Patapsco Avenue  
Baltimore, Maryland 21230



Rajant Corporation  
XLE

CFR Title 47, Part 15, Subpart C

## Electromagnetic Compatibility Test Report

for the

**Rajant Corporation  
XLE**

### Tested Under

the FCC Certification Rules  
contained in  
Title 47 of the CFR, Part 15.247, Subpart C  
for Intentional Radiators

Dusmantha Tennakoon  
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 15.407, of the FCC Rules under normal use and maintenance.

Shawn McMillen,  
Wireless Manager, Electromagnetic Compatibility Lab



Rajant Corporation  
XLE

CFR Title 47, Part 15, Subpart C

## Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	March 6, 2008	Initial Issue.



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## List of Terms and Abbreviations

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



Rajant Corporation  
XLE

Executive Summary  
CFR Title 47, Part 15, Subpart C

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# **I. Executive Summary**





## 1.1 Purpose of Test

An EMC evaluation was performed to determine compliance of the Rajant Corporation, XLE, with the requirements of Part 15, §15.247. 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 XLE. Rajant Corporation should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the XLE, has been **permanently** discontinued

## 1.2 Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, §15.247, in accordance with Rajant Corporation, purchase order number 2007211. All tests were conducted using measurement procedure ANSI C63.4-2003.

Reference	Description	Results
Title 47 of the CFR, Part 15, Subpart C, §15.203/15.247(b)(c)	Antenna Requirement	Compliant
Title 47 of the CFR, Part 15, Subpart C, §15.205(d)	Band Edge Emissions	Compliant
Title 47 of the CFR, Part 15, Subpart C, §15.247(d)	Spurious Radiated Emissions	Compliant

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



Rajant Corporation  
XLE

Electromagnetic Compatibility  
Equipment Configuration  
CFR Title 47, Part 15, Subpart C

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## II. Equipment Configuration



## 2.1 Overview

MET Laboratories, Inc. was contracted by Rajant Corporation to perform testing on the XLE, under Rajant Corporation's purchase order number 2007211.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Rajant Corporation, XLE.

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

<b>Filing Status:</b>	Class II Permissive Change	
<b>Model(s) Tested:</b>	XLE	
<b>Model(s) Covered:</b>	XLE	
<b>EUT Specifications:</b>	Primary Power: 120VAC, 60 Hz	
	Secondary Power: 12 VDC Lead Acid Battery	
	FCC ID: VJA-XLE	
	Type of Modulations:	DSSS, BPSK, QPSK, CCK
	Equipment Code:	DTS
	Peak RF Conducted Output Power:	26.05 dBm
	EUT TX Frequency Ranges:	2412 – 2462 MHz
<b>Analysis:</b>	The results obtained relate only to the item(s) tested.	
<b>Evaluated by:</b>	Dusmantha Tennakoon	
<b>Date(s):</b>	March 6, 2008	

Note: The EUT only operates on channel 1 and 11.



## 2.2 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>CFR 47, Part 15, Subpart B</b>	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
<b>ANSI C63.4:2003</b>	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
<b>ANSI/NCSL Z540-1-1994</b>	Calibration Laboratories and Measuring and Test Equipment - General Requirements
<b>ANSI/ISO/IEC 17025:2000</b>	General Requirements for the Competence of Testing and Calibration Laboratories

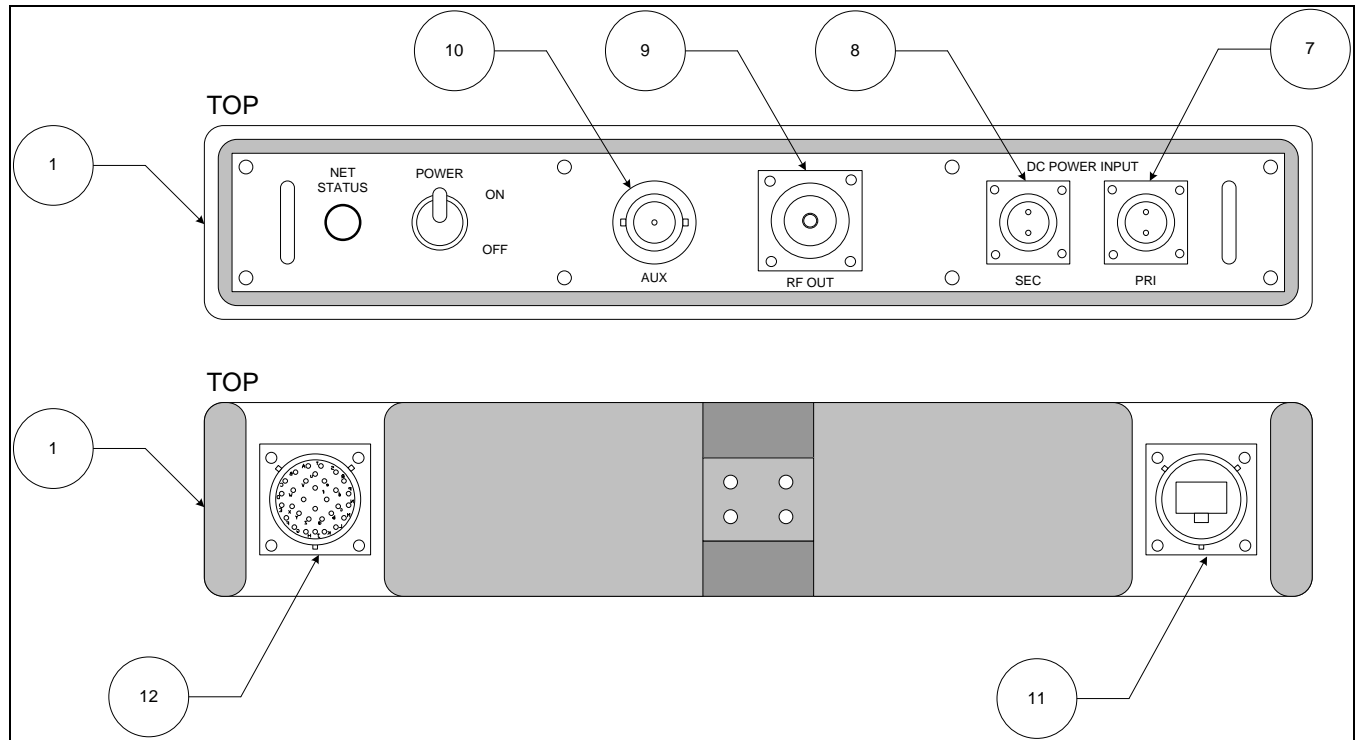
## 2.3 Test Site

All testing was performed at MET Laboratories, Inc., 914 West Patapsco Avenue, 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 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).

## 2.4 Description of Test Sample

The XLE, Equipment Under Test (EUT), is a portable networking device that supports wired and wireless routing, and amplified 802.11b access point/bridging/meshing functionality. It can encode an analog video stream. It can be powered from external batteries or an external AC/DC power supply.



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

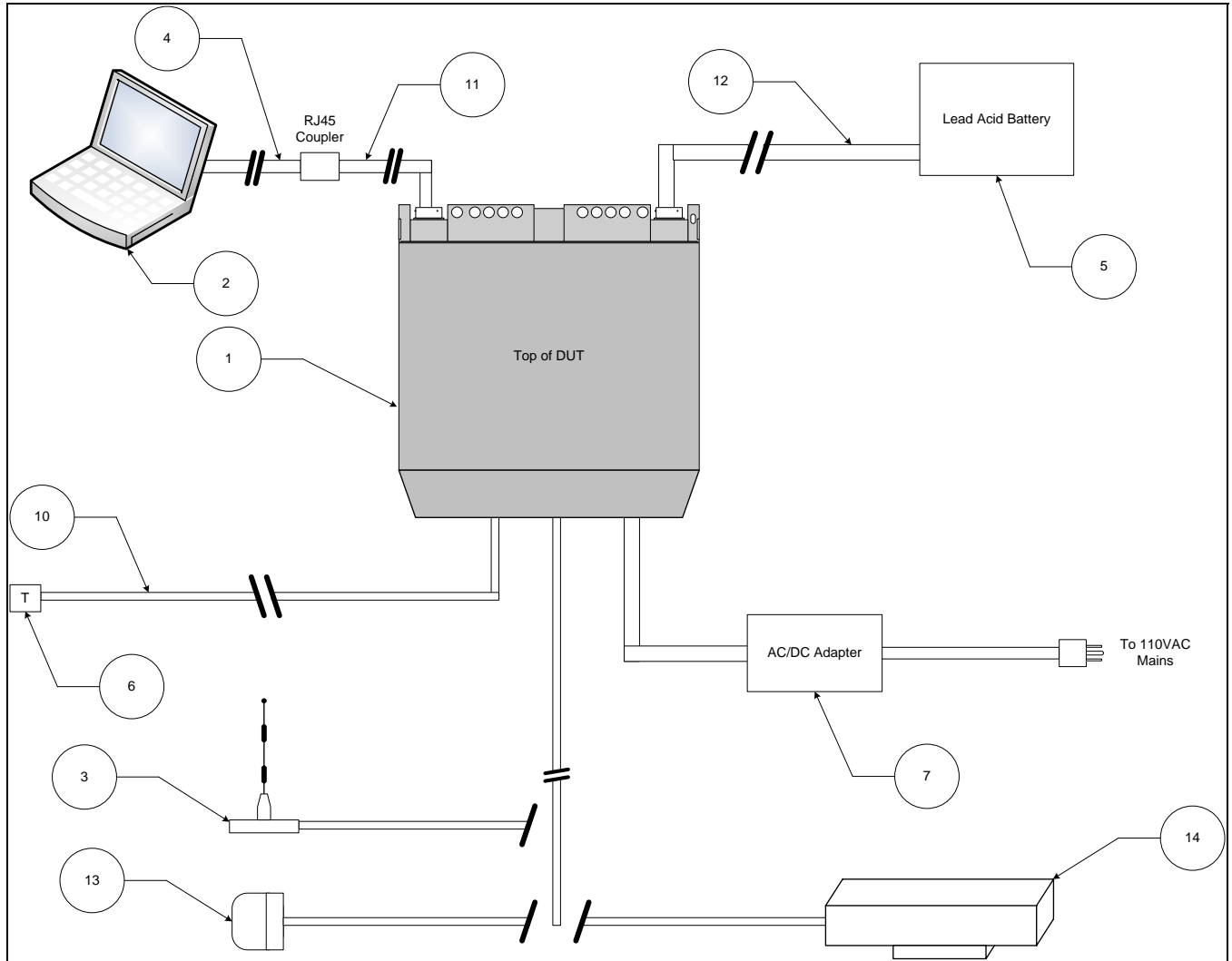


Figure 2. Block Diagram of Test Configuration, Cabling



## 2.5 Equipment Configuration

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

Ref. ID	Name / Description	Serial Number
1	XLE	XLE2E10-1197

Table 2. Equipment Configuration

## 2.6 Support Equipment

Rajant Corporation supplied support equipment necessary for the operation and testing of the XLE. All support equipment supplied is listed in the following Support Equipment List.

Ref. ID	Name / Description	Manufacturer	Model Number	Serial Number
2	LAPTOP	IBM	THINKPAD	N/A
3	7DBI ANTENNA, MAG.MOUNT OMNI, TYPE- N	PACIFIC WIRELESS	MA24-7 W/MM-90 MOUNT	N/A
4	CAT5E ETHERNET CABLE	N/A	N/A	N/A
5	LEAD ACID BATTERY	N/A	N/A	N/A
6	75OHM TERMINATOR	N/A	N/A	N/A
13	6 DBI CUPCAKE ANTENNA	WIFI PLUS	WFP0200507	N/A
14	120 DEG SECTOR, 9DBI	PACIFIC WIRELESS	SA24-120-9	N/A

Table 3. Support Equipment



## 2.7 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
7	PRI POWER CONNECTOR	XLE AC/DC POWER SUPPLY	1	~8.0FT	N	110 AC MAINS
8	SEC POWER CONNECTOR	NONE – WOULD SWAP BETWEEN ANOTHER AC SUPPLY FOR POWERED CONTINUITY	0	N/A	N	N/A
9	RF OUT	ANTENNA, OMNI, 7DBI, MAG.MOUNT, TYPE-N	1	12.0IN	N	7DBI OMNIDIRECTIONAL MAG.MOUNT ANTENNA (3)
10	AUX	VIDEO, 75OHM, BNC CABLE	1	N/A	Y	N/A – 75OHM TERMINATOR
11	ETHERNET PORT	XL ETHERNET CABLE	1	~8.0FT	N	CAT5E CABLE (4) AND LAPTOP (2)
12	REAR AUX PORT	VEHICLE POWER CABLE	1	8.0FT	N	LEAD ACID BATTERY(5)

Table 4. Ports and Cabling Information

## 2.8 Mode of Operation

The unit will simulate a network packing routing operation internally and by fully exercising the radio transceiver cards by forcing them into a mode where they continuously transmit. A setup procedure will be found on the controlling laptop.

## 2.9 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.

## 2.10 Disposition of EUT

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





Rajant Corporation  
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Electromagnetic Compatibility  
Criteria for Intentional Radiators  
CFR Title 47, Part 15, Subpart C

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### **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.

**Results:** The antennas are professionally installed. §15.203 does not apply because the antenna is professionally installed. Please refer to the user manual for guidance on the professional antenna installation. The Class II Permissive Change is to add the following antennas:

Antenna Type	Gain	Manufacturer
Monopole (Magnetic-mount, N type)	7 dBi	Pacific Wireless
Omni	6 dBi	WiFi – Plus, Inc.
120° Sector	9 dBi	Pacific Wireless

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

**Test Date(s):** 10/29/07



## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.205 Band Edge Emissions

**Test Requirement(s):** § 15.205 (a): Except as shown in paragraph (d) of **15.205 Restricted bands of operation**, only spurious emissions are permitted in any of the frequency bands specified in Table 5:

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
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	Note
13.36–13.41.			
Note : Above 38.6			

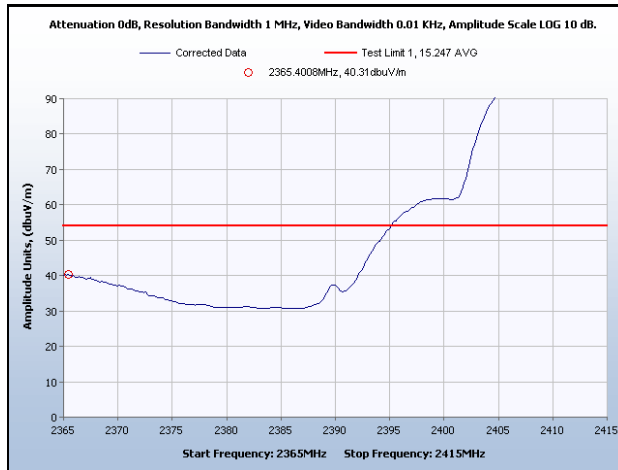
**Table 5. Restricted Bands of Operation from FCC Part 15, § 15.205**

**Test Procedure:** The EUT was set up at maximum power. It was verified that the channels tested were within the band 2400-2480 MHz and not infringing upon the restricted bands.

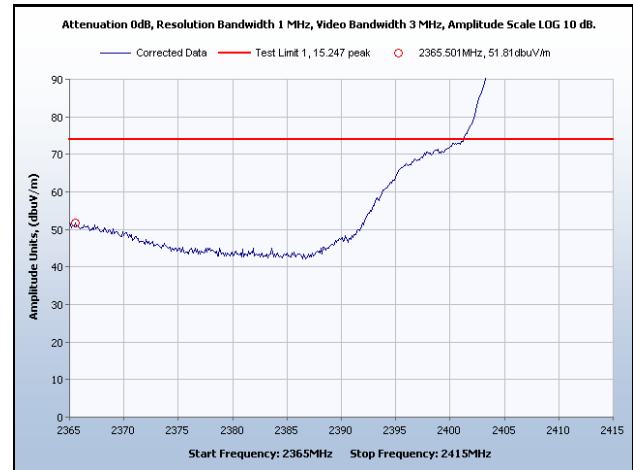
**Test Results:** The EUT was compliant with the requirements of this section.

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

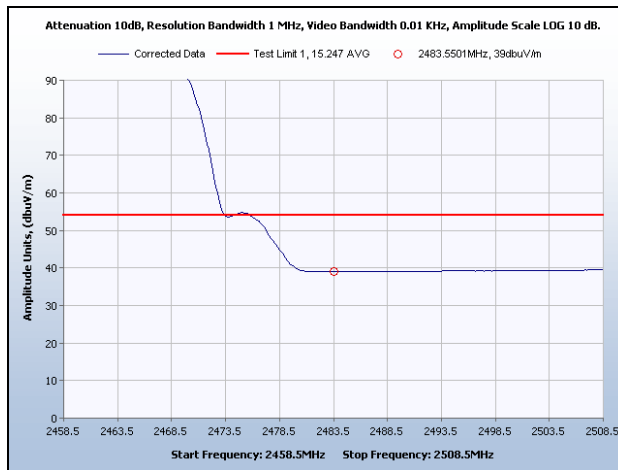
**Test Date(s):** 08/28/2007 – 02/04/2008



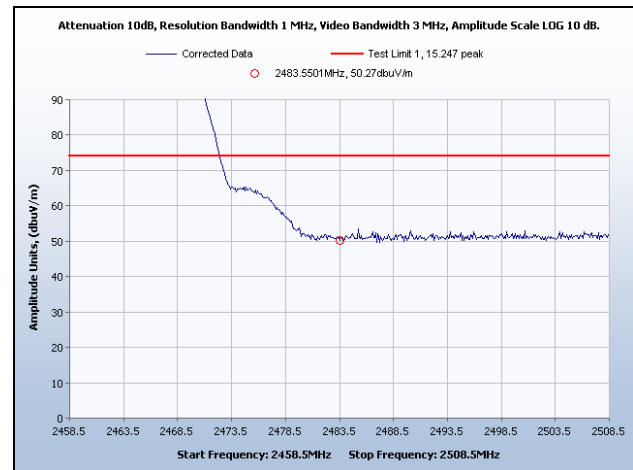
Band Edge, 6 dBi Omni, Channel 1, Avg., Vertical



Band Edge, 6 dBi Omni, Channel 1, Peak, Vertical



Band Edge, 6 dBi Omni, Channel 11, Avg., Vertical

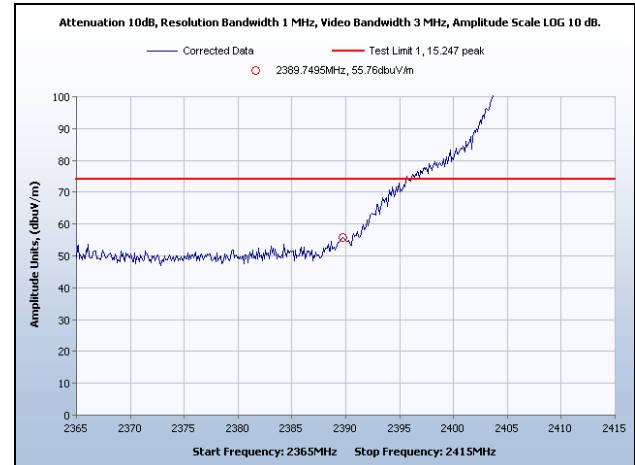
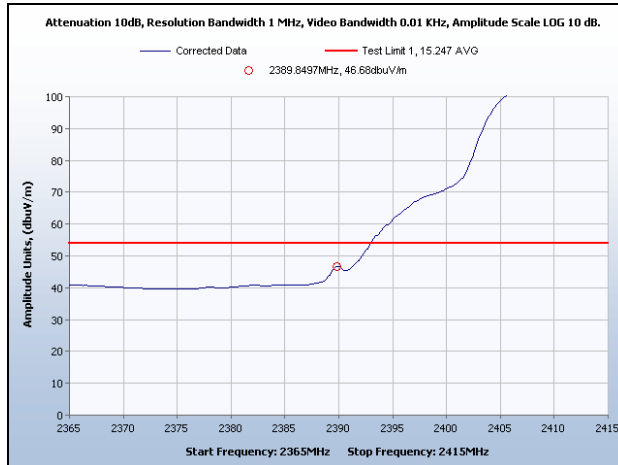


Band Edge, 6 dBi Omni, Channel 11, Peak, Vertical

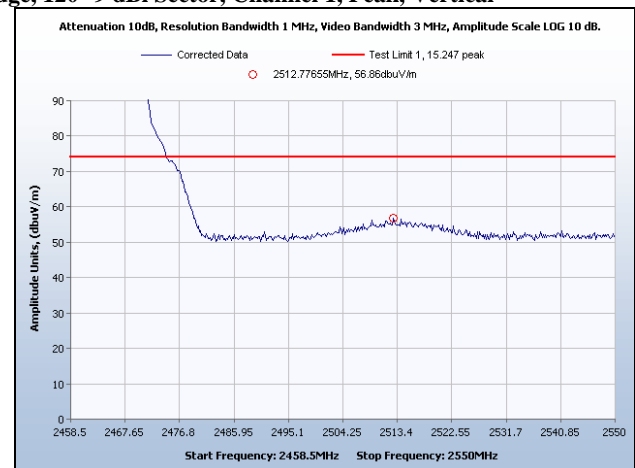
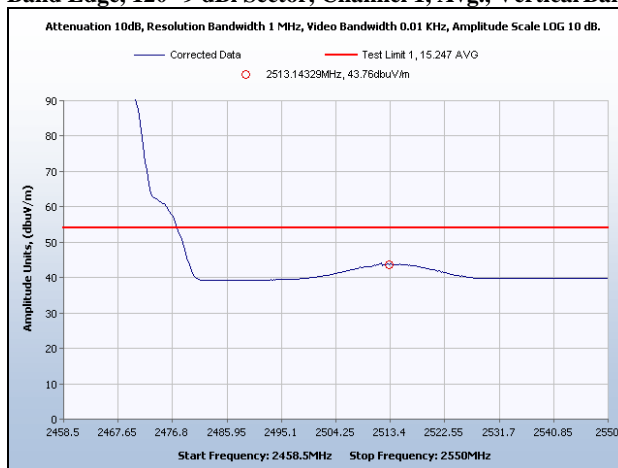


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Electromagnetic Compatibility  
Criteria for Intentional Radiators  
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Band Edge, 120° 9 dBi Sector, Channel 1, Avg., Vertical Band Edge, 120° 9 dBi Sector, Channel 1, Peak, Vertical



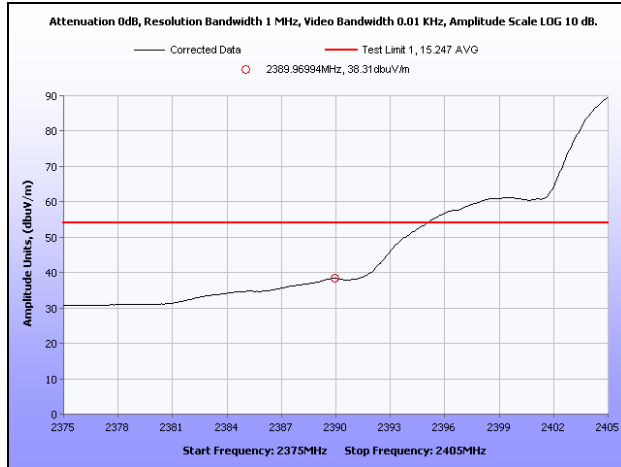
Band Edge, 120° 9 dBi Sector, Channel 11, Avg., Vertical

Band Edge, 120° 9 dBi Sector, Channel 11, Peak, Vertical

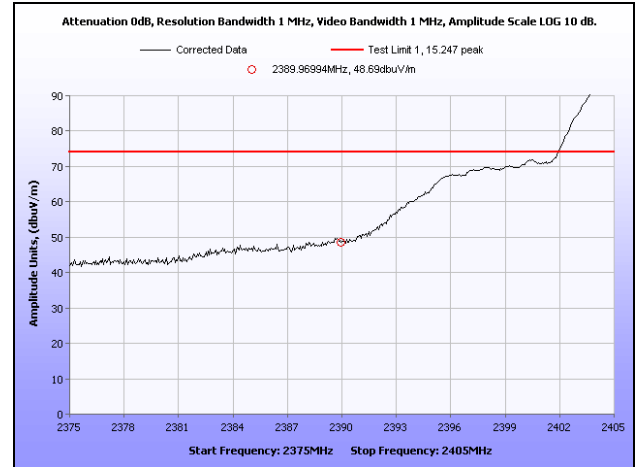


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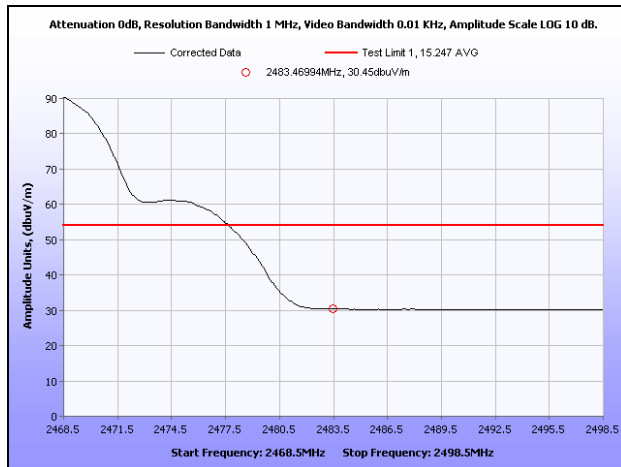
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CFR Title 47, Part 15, Subpart C



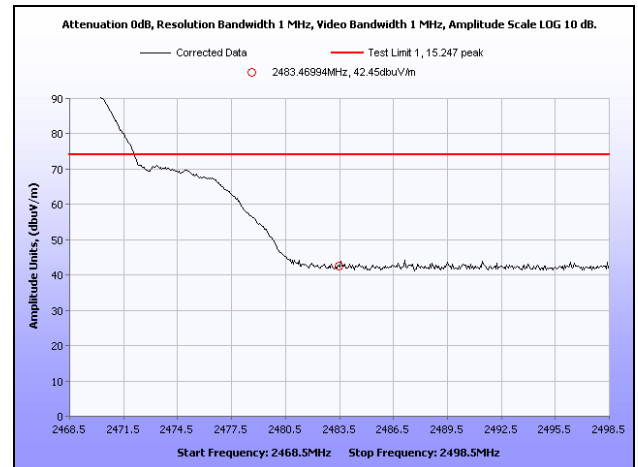
Band Edge, 7 dBi, Channel 1, Avg., Vertical



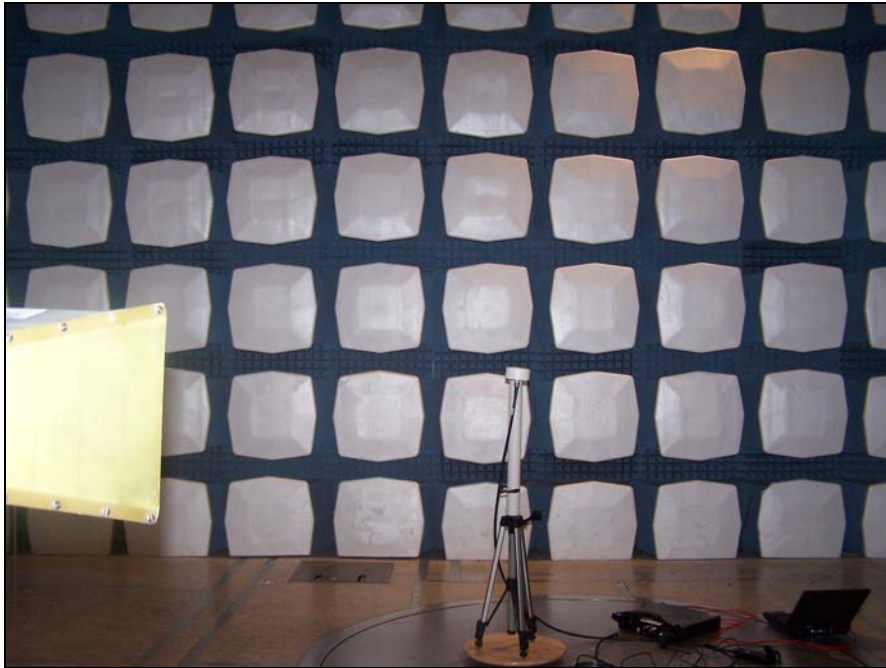
Band Edge, 7 dBi, Channel 1, Peak, Vertical



Band Edge, 7 dBi, Channel 11, Avg., Vertical



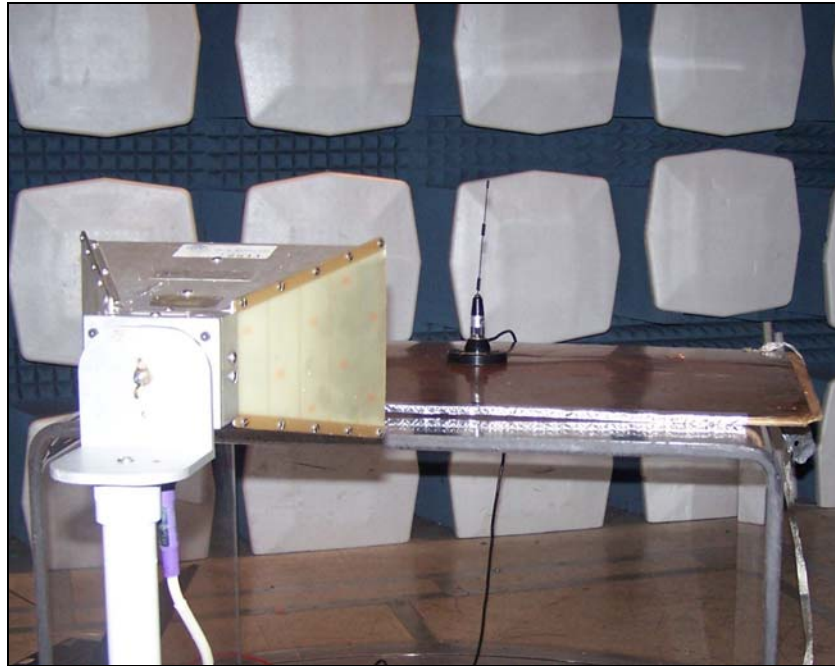
Band Edge, 7 dBi, Channel 11, Peak, Vertical



**Photograph 1. Band Edge, 6 dBi Omni, Test Setup**



**Photograph 2. Band Edge, 120° 9 dBi Sector, Test Setup**



**Photograph 3. Band Edge, 7 dBi, Test Setup**



## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.209 Radiated Emissions –Spurious

**Test Requirement(s):** § 15.205 (a): Except as shown in paragraph (d) of 15.205 Restricted bands of operation, only spurious emissions are permitted in any of the frequency bands specified in Table 6:

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
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	Note
13.36–13.41.			
Note: Above 38.6			

**Table 6. Restricted Bands of Operation from FCC Part 15, § 15.205**

**§ 15.205 (b):** (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

**§ 15.35 (b):** ...When average radiated emission measurements are specified in this part, including emission measurements below 1000 MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules...



Frequency (MHz)	Field Strength (Microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F (kHz)	300
0.490 – 1.705	24000/F (kHz)	30
1.705 – 30.0	30	30
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

\*\* Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

**Table 7. Radiated Emissions Limits from § 15.209 (a)**

**Test Procedure:**

For intentional radiators with a digital device portion which operates below 10 GHz, the spectrum was investigated as per §15.33(a)(1) and §15.33(a)(4); i.e., the lowest RF signal generated or used in the device up to the 10<sup>th</sup> harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

In accordance with §15.35 (b) the limit on the radio frequency emissions as measured using instrumentation with a peak detector function shall be 20 dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules.

For radiated Spurious emissions, the EUT was scanned from 1 GHz to 18 GHz. In order to demonstrate compliance, measurements were taken in the form of peak plots shown with a peak and an average limit line. The plots were made at a 1m measurement distance and corrected for cable loss, distance correction, and antenna correction factors, by the capture software. At each channel of interest, the EUT was rotated about all three of its orthogonal axes.

Peak measurements, which exceeded the average limit line were re-measured using video averaging and plotted against an average limit line. Channels 1 and 11 were tested.

**Test Results:**

The EUT was compliant with the requirements of this section.

**Test Engineer(s):**

Dusmantha Tennakoon

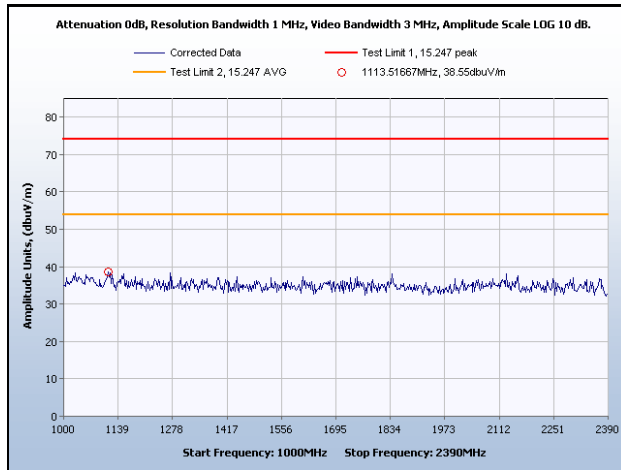
**Test Date(s):**

08/28/2007 – 02/04/2008

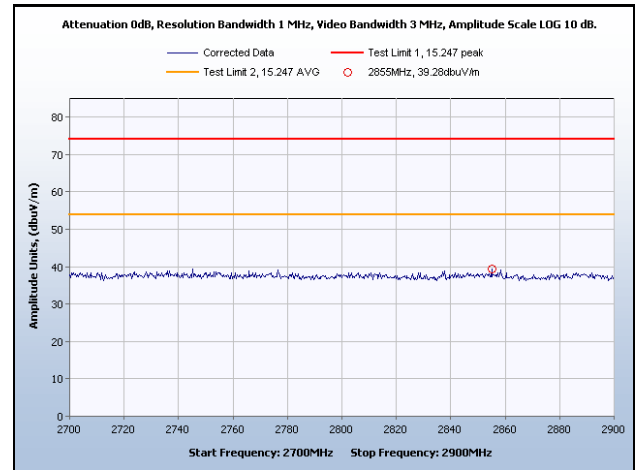


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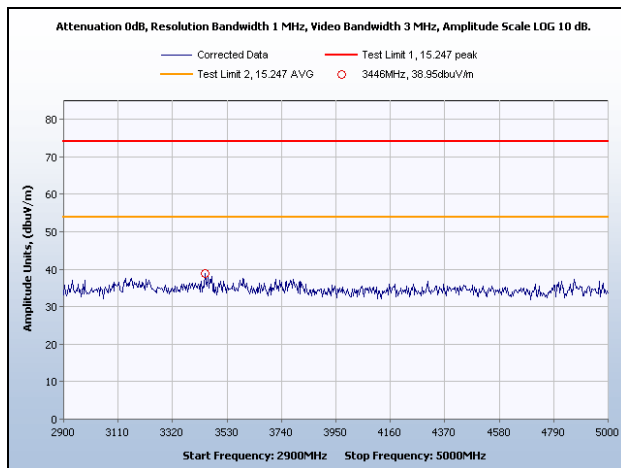
Electromagnetic Compatibility  
Criteria for Intentional Radiators  
CFR Title 47, Part 15, Subpart C



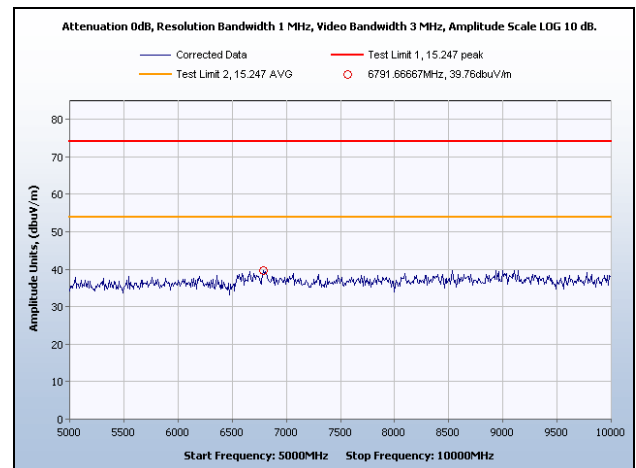
Radiated Spurious Emissions, 6 dBi Omni, 1-2.39 GHz, Vertical



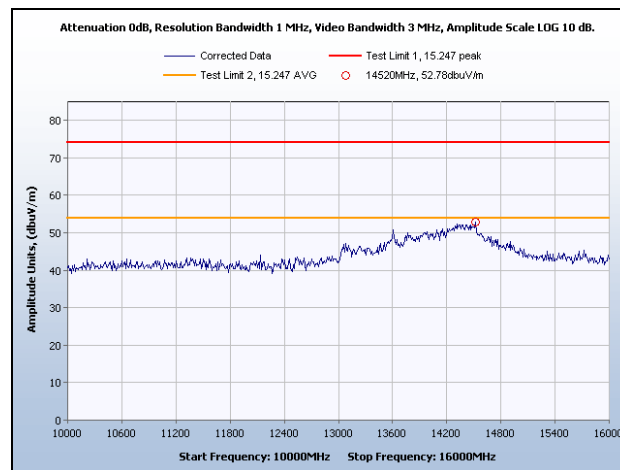
Radiated Spurious Emissions, 6 dBi Omni, 2.7-2.9 GHz, Vertical



Radiated Spurious Emissions, 6 dBi Omni, 2.9-5 GHz, Vertical



Radiated Spurious Emissions, 6 dBi Omni, 5-10 GHz, Vertical

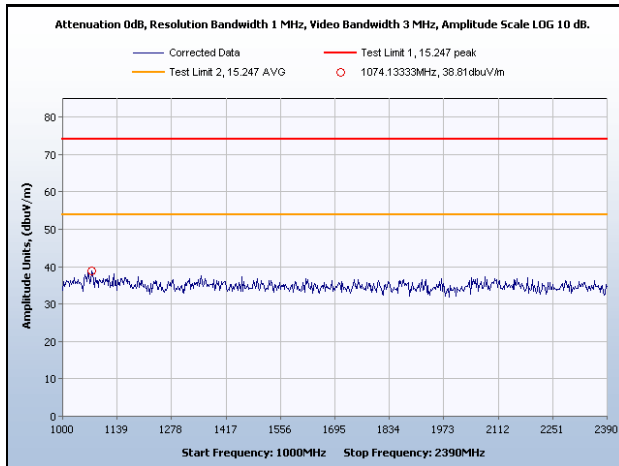


Radiated Spurious Emissions, 6 dBi Omni, 10-16 GHz, Vertical

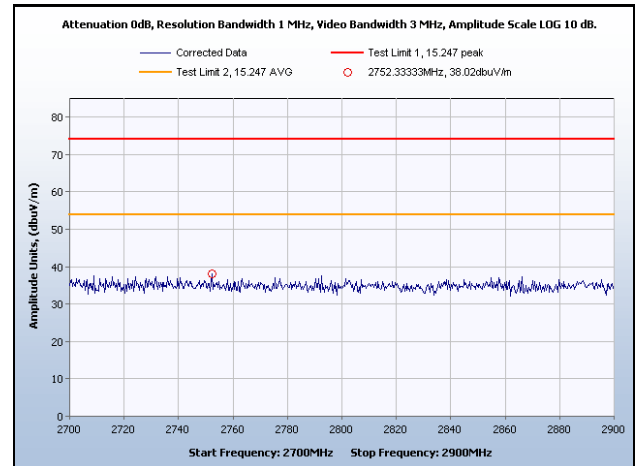


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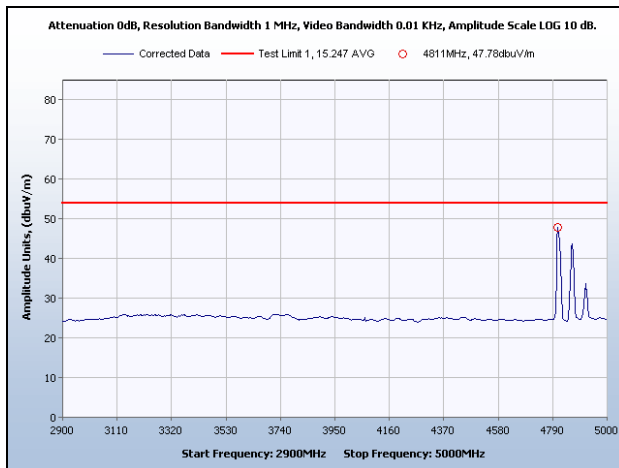
Electromagnetic Compatibility  
Criteria for Intentional Radiators  
CFR Title 47, Part 15, Subpart C



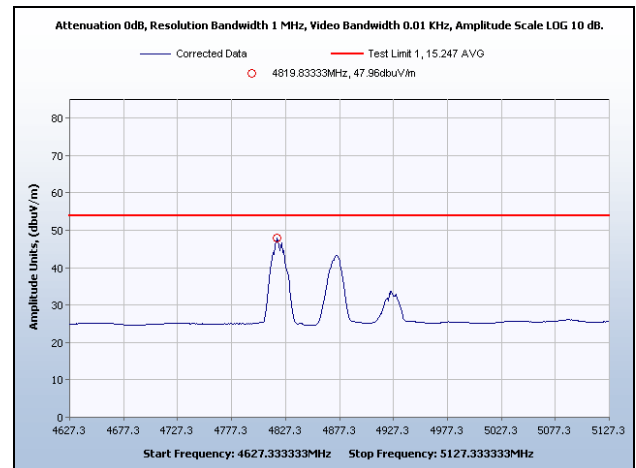
Radiated Spurious Emissions, 120° 9 dBi Sector, 1-2.39 GHz, Vertical



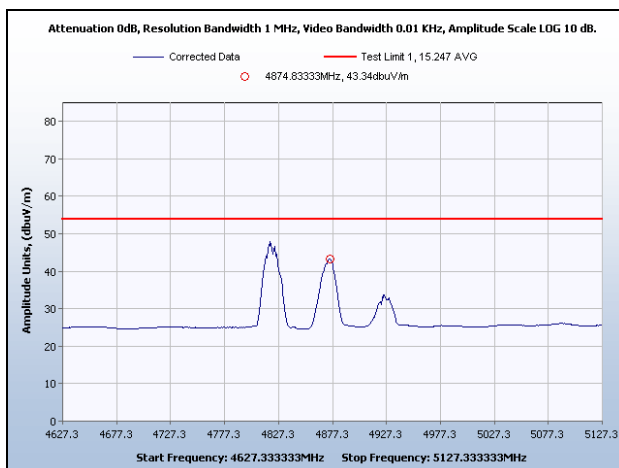
Radiated Spurious Emissions, 120° 9 dBi Sector, 2.7-2.9 GHz, Vertical



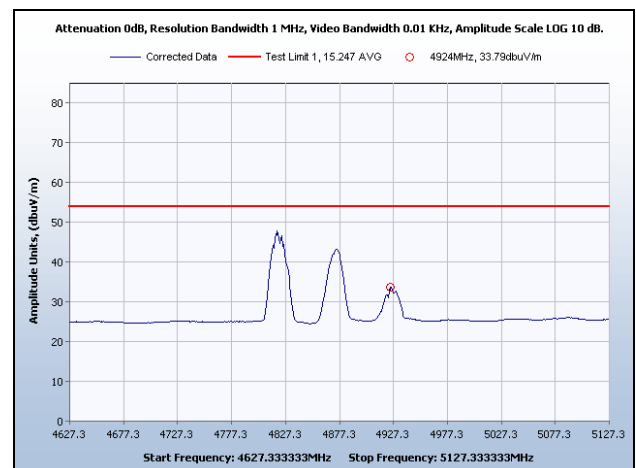
Radiated Spurious Emissions, 120° 9 dBi Sector, 2.9-5 GHz, Avg., Vert.



Radiated Spurious Emissions, 120° 9 dBi Sector, 2.9-5 GHz, Avg., Vert. 1



Radiated Spurious Emissions, 120° 9 dBi Sector, 2.9-5 GHz, Avg., Vert. 2

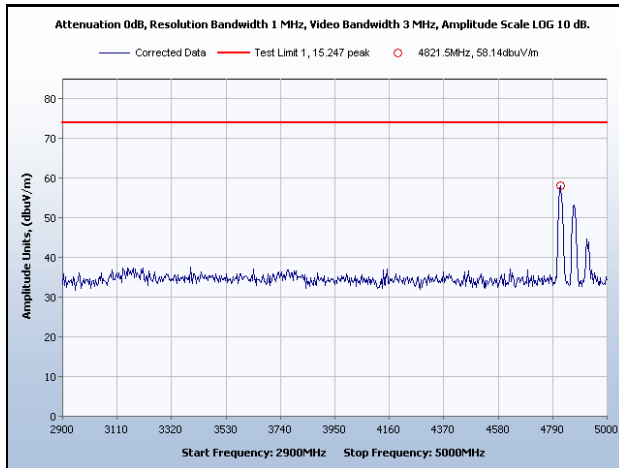


Radiated Spurious Emissions, 120° 9 dBi Sector, 2.9-5 GHz, Avg., Vert. 3

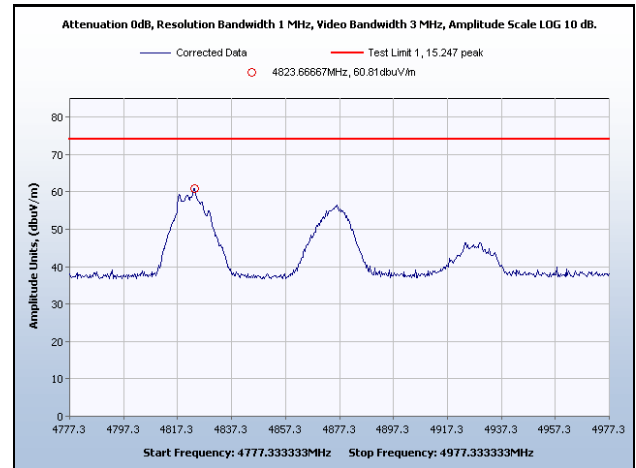


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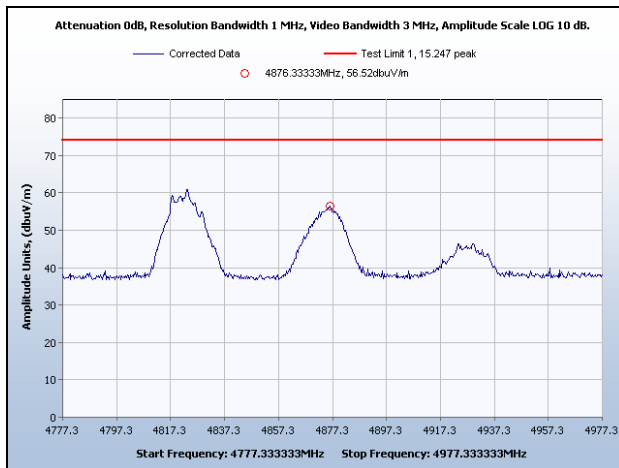
Electromagnetic Compatibility  
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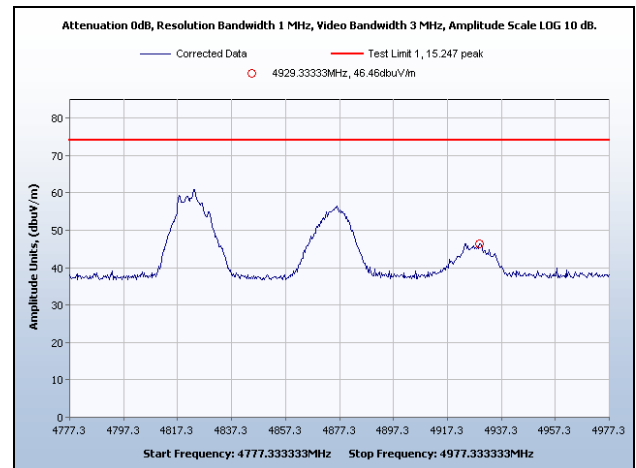
Radiated Spurious Emissions, 120° 9 dBi Sector, 2.9-5 GHz, Peak Vert.



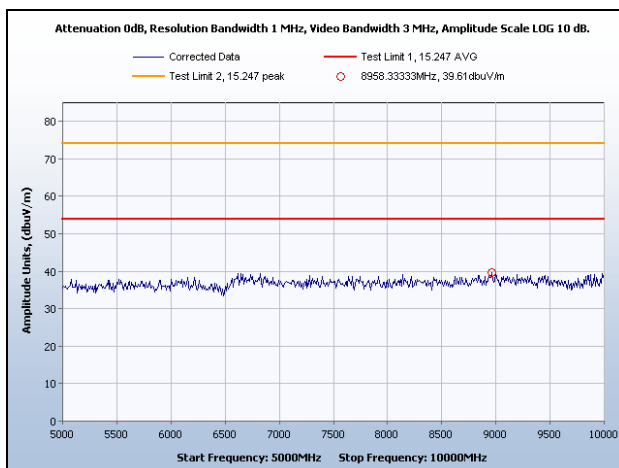
Radiated Spurious Emissions, 120° 9 dBi Sector, 2.9-5 GHz, Peak Vert. 1



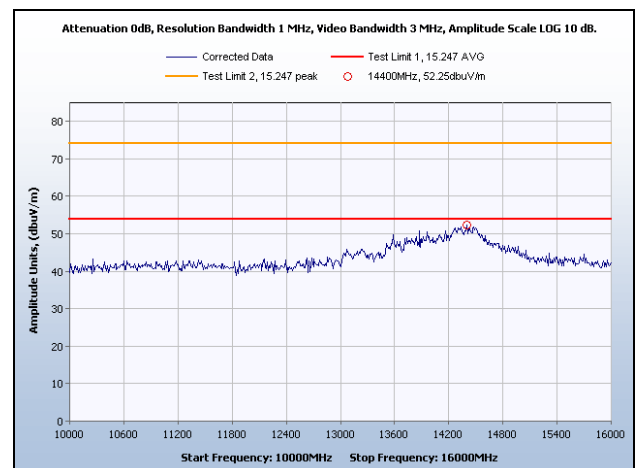
Radiated Spurious Emissions, 120° 9 dBi Sector, 2.9-5 GHz, Peak Vert. 2



Radiated Spurious Emissions, 120° 9 dBi Sector, 2.9-5 GHz, Peak Vert. 3



Radiated Spurious Emissions, 120° 9 dBi Sector, 5-10 GHz, Vertical

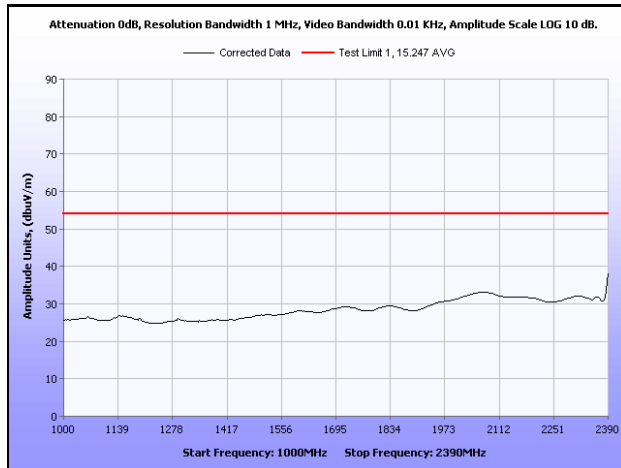


Radiated Spurious Emissions, 120° 9 dBi Sector, 10-16 GHz, Vertical

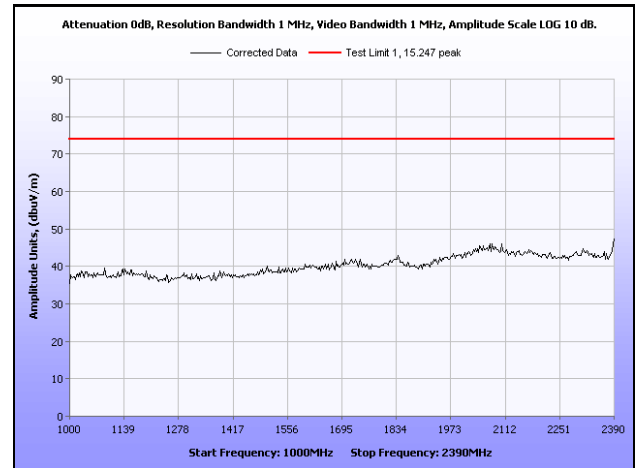


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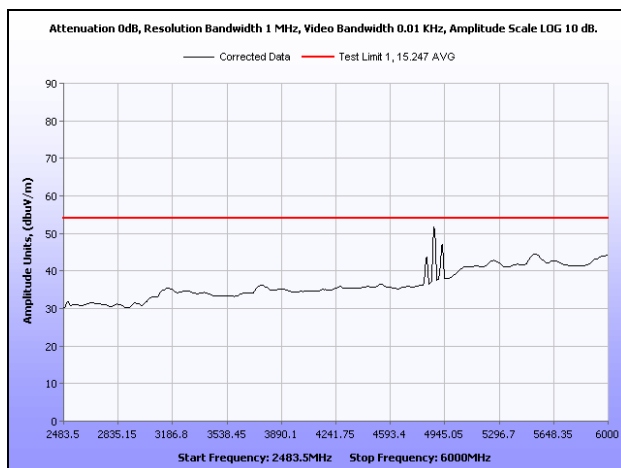
Electromagnetic Compatibility  
Criteria for Intentional Radiators  
CFR Title 47, Part 15, Subpart C



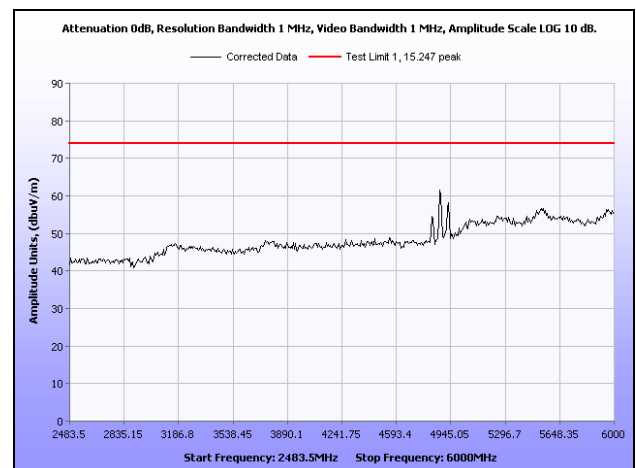
Radiated Spurious Emissions, 7 dBi, Average, 1-2.39 GHz



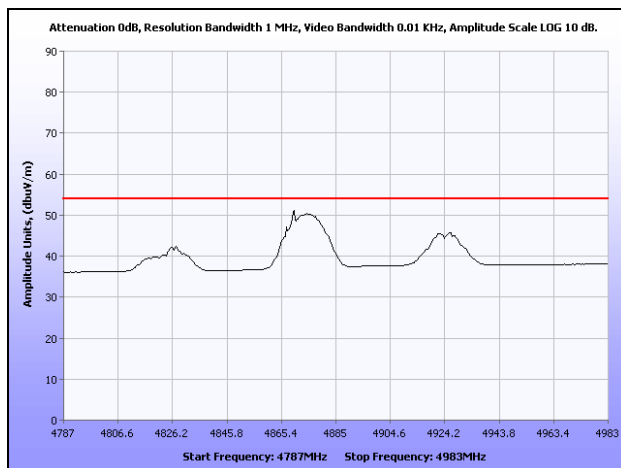
Radiated Spurious Emissions, 7 dBi, Peak, 1-2.39 GHz



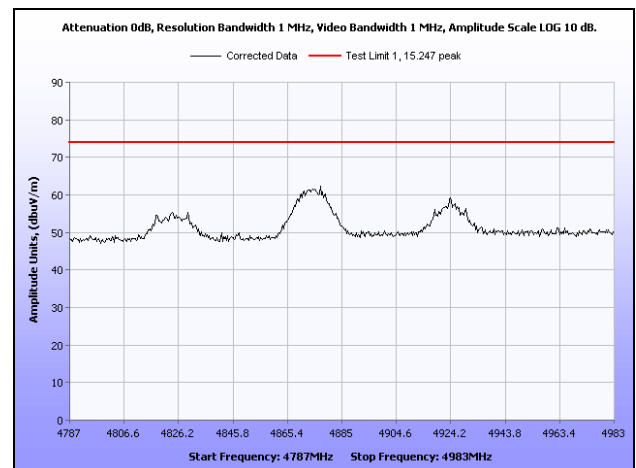
Radiated Spurious Emissions, 7 dBi, Average, 2.4835-6 GHz



Radiated Spurious Emissions, 7 dBi, Peak, 2.4835-6 GHz



Radiated Spurious Emissions, 7 dBi, Average, 4.787-4.983 GHz

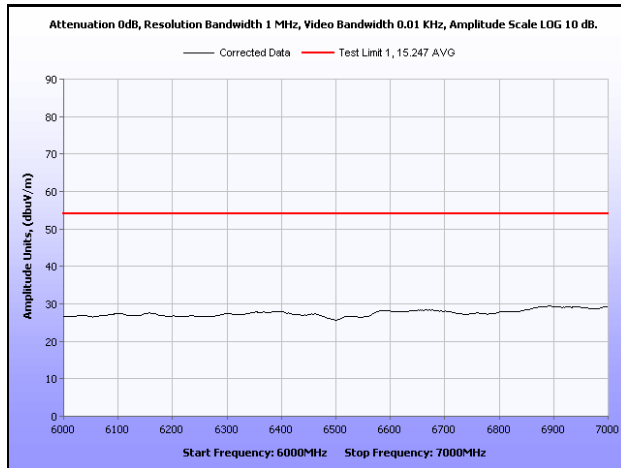


Radiated Spurious Emissions, 7 dBi, Peak, 4.787-4.983 GHz

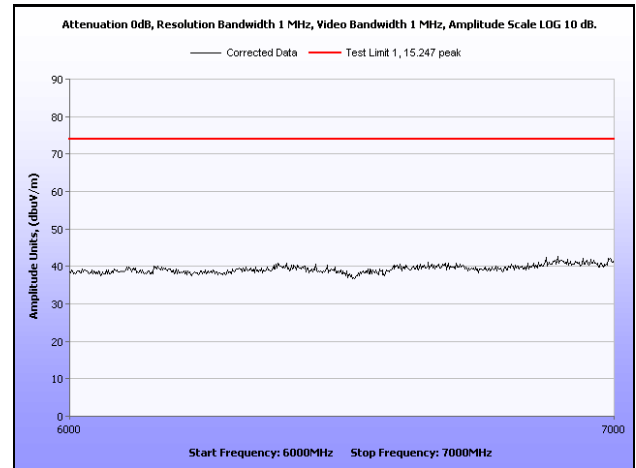


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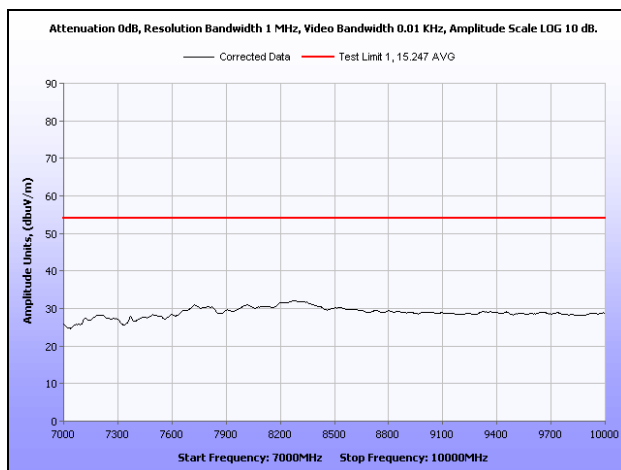
Electromagnetic Compatibility  
Criteria for Intentional Radiators  
CFR Title 47, Part 15, Subpart C



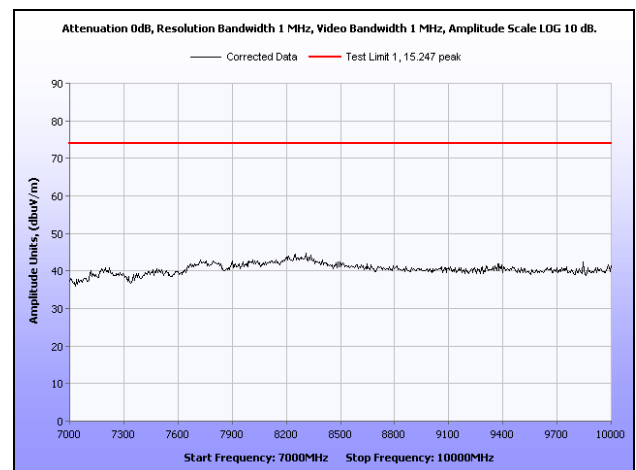
Radiated Spurious Emissions, 7 dBi, Average, 6-7GHz



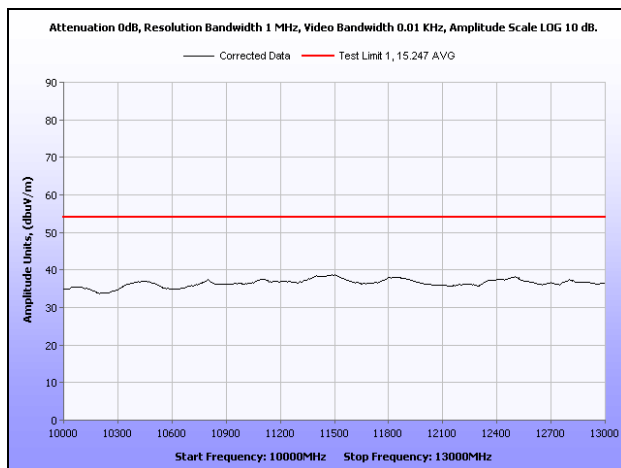
Radiated Spurious Emissions, 7 dBi, Peak, 6-7GHz



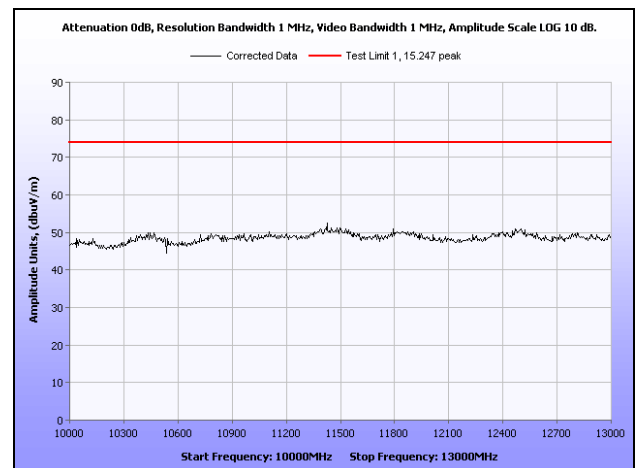
Radiated Spurious Emissions, 7 dBi, Average, 7-10 GHz



Radiated Spurious Emissions, 7 dBi, Peak, 7-10 GHz



Radiated Spurious Emissions, 7 dBi, Average, 10-13 GHz

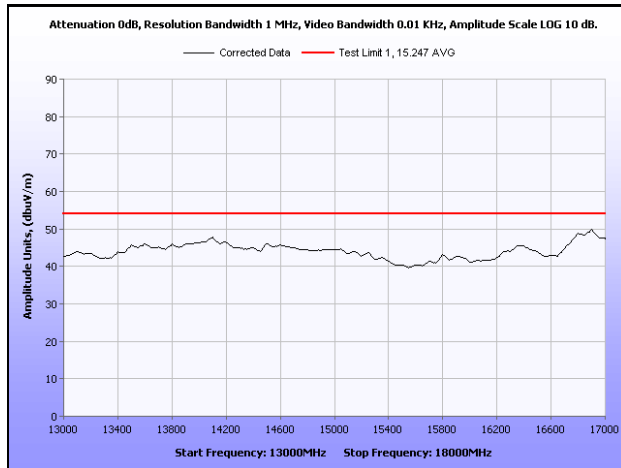


Radiated Spurious Emissions, 7 dBi, Peak, 10-13 GHz

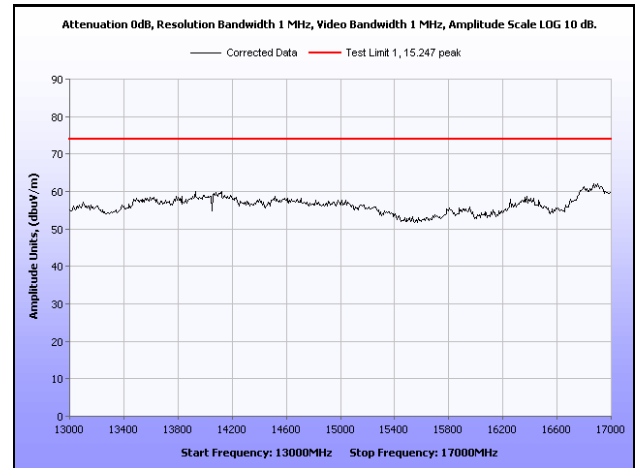


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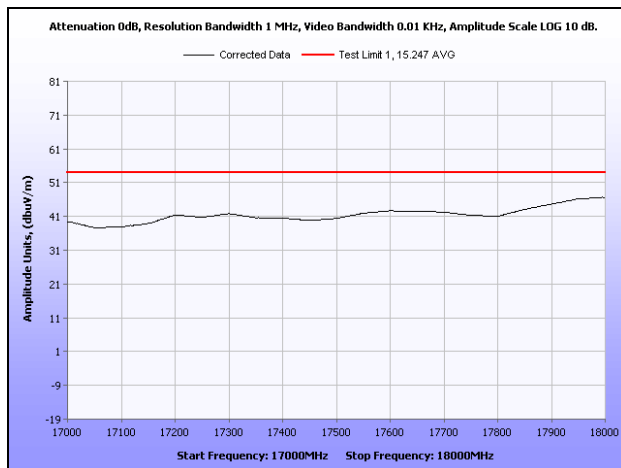
Electromagnetic Compatibility  
Criteria for Intentional Radiators  
CFR Title 47, Part 15, Subpart C



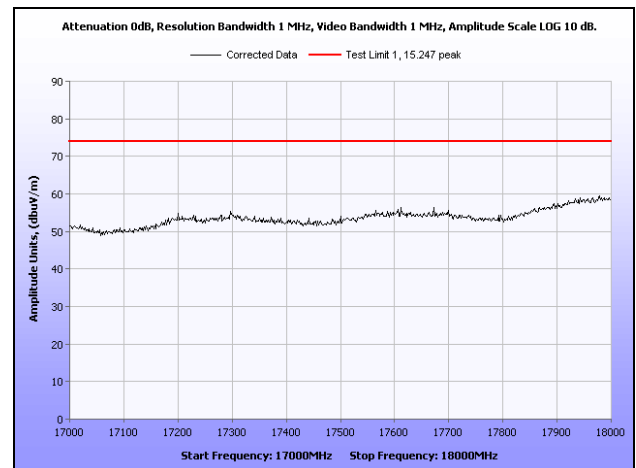
Radiated Spurious Emissions, 7 dBi, Average, 13-17 GHz



Radiated Spurious Emissions, 7 dBi, Peak, 13-17 GHz



Radiated Spurious Emissions, 7 dBi, Average, 17-18 GHz

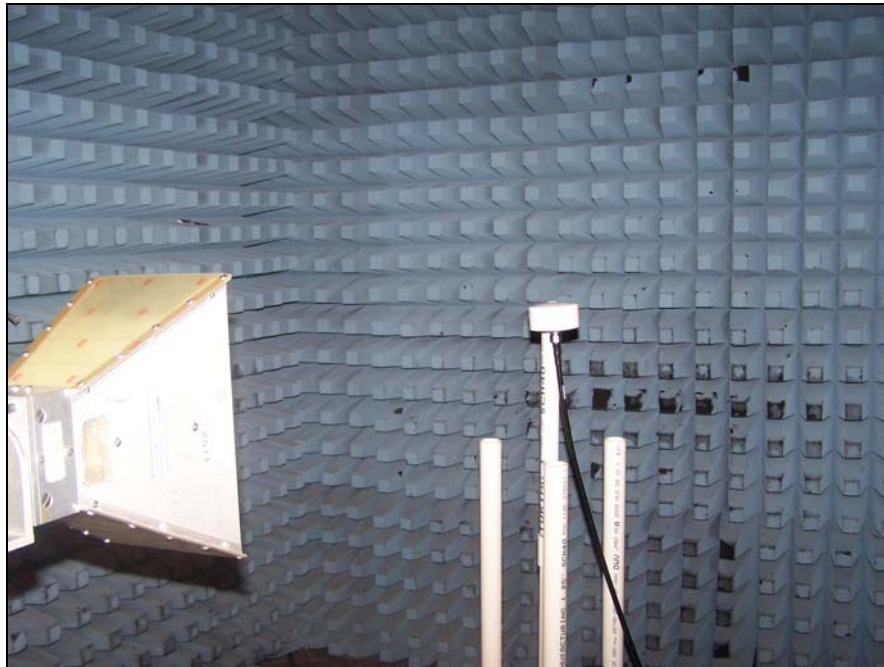


Radiated Spurious Emissions, 7 dBi, Peak, 17-18 GHz



## Electromagnetic Compatibility Criteria for Intentional Radiators

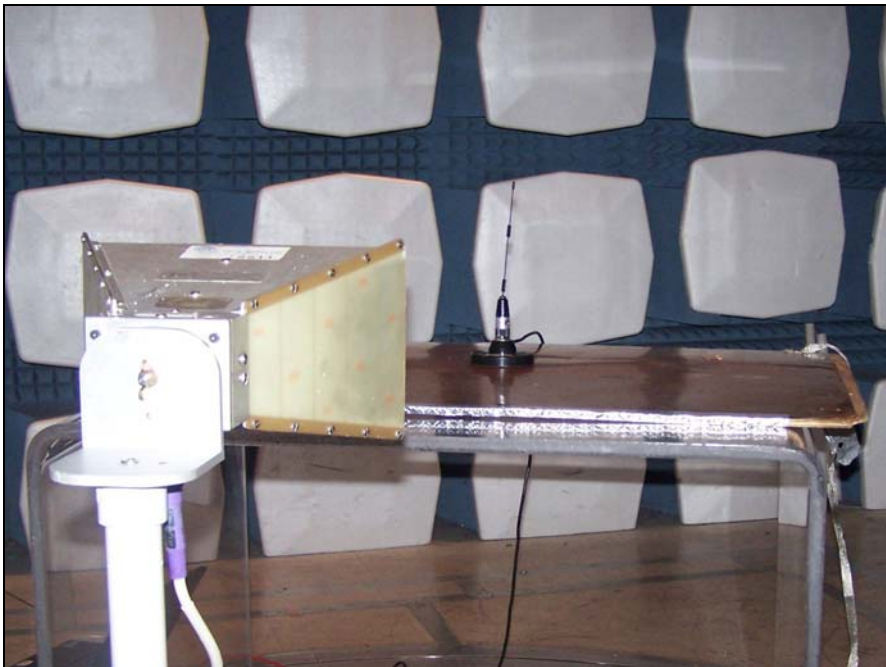
### § 15.109; § 15.209 Radiated Emissions Limits



**Photograph 4. Spurious Radiated Emissions, Test Setup, 6 dBi Omni**



**Photograph 5. Spurious Radiated Emissions, Test Setup, 120° 9 dBi Sector**



**Photograph 6. Spurious Radiated Emissions, Test Setup, 7 dBi**



## 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.

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Average Time (minutes)
<b>(A) Limits for Occupational/Control Exposures</b>				
30-300	61.4	0.163	1.0	6
300-1,500	--	--	F/300	6
1,500-100,000	--	--	5	6
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
30-300	27.5	0.073	0.2	30
300-1,500	--	--	F/1,500	30
1,500-100,000	--	--	1.0	30

**Table 8. Limits for Maximum Permissible Exposure**

Note: F=Frequency in MHz

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

$$S = PG / 4\pi R^2$$

where, S = Power Density mW/m<sup>2</sup>  
P = Power Input to antenna milli Watts  
G = Numeric Antenna Gain  
R = Distance to the center of radiation of the antenna (20 cm for Mobile minimum distance)



## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(b) RF Exposure

**Test Procedures:** The MPE was calculated from obtained power measurements.

**Test Results:** MPE Limit Calculation: EUT's operating frequencies @ 2412 and 2462 MHz; only channel 1 and 11 are active on this unit. Highest conducted power = 26.05 dBm (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm<sup>2</sup>**.  
The following antennas will be used under the Class II change:

6 dBi Omni directional antenna  
7 dBi Monopole antenna  
9 dBi 120 degree antenna

EUT maximum antenna gain = 9 dBi.

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

$$S = PG / 4\pi R^2$$

where, S = Power Density mW/m<sup>2</sup>  
P = Power Input to antenna mili Watts  
G = Numeric Antenna Gain  
R = Distance to the center of radiation of the antenna (20 cm for Mobile minimum distance)

$$\text{Antenna Numeric Gain} = 10^{\text{dBi}/10}$$

Power at antenna port = 403.7 mW

Antenna Gain = 9 dBi

$$\text{Numeric antenna gain} = 10^{9/10} = 7.94$$

$$S = (403.7)(7.94) / 4(3.1416)(20)^2$$

$$S = 0.638 \text{ mW/cm}^2$$

Therefore, EUT meets the Uncontrolled Exposure limit.

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

**Test Date(s):** 08/29/2007



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Electromagnetic Compatibility  
Test Equipment  
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## IV. Test Equipment



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Test Equipment  
CFR Title 47, Part 15, Subpart C

## Test Equipment

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

Test Name: Band Edge				Test Date : 08/28/2007 – 02/04/2008	
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1 EMCT4300	SEMI-ANECHOIC CHAMBER # 1	EMC TEST SYSTEMS	NONE	02/17/2006	01/17/2009
1 EMCT4409	EMI RECEIVER	ROHDE & SCHWARTZ	ESIB7	04/24/2007	04/24/2008
1 EMCT2665	ANTENNA; HORN	EMCO	3115	04/17/2007	04/17/2008
Test Name: Spurious Emissions				Test Date : 08/28/2007 – 02/04/2008	
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4288	SPECTRUM ANALYZER	HEWLETT PACKARD	8563A	07/05/2007	07/05/2008
1T4148	SHIELD ROOM #2 SEMI-ANECHOIC	RANTEC	20	12/28/2006	12/28/2007
1T2665	ANTENNA; HORN	EMCO	3115	04/17/2007	04/17/2008
1T4414	MICROWAVE PRE-AMPLIFIER	AH SYSTEMS	PAM-0118	SEE NOTE	
1T4592	RF FILTER KIT	VARIOUS	N/A	SEE NOTE	

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



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



## Certification & User's Manual Information

### 5.1 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 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.

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<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

### 5.2 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 his 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 in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, 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.