



## 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

May 20, 2009

System Planning Corporation  
1000 Wilson Blvd.  
Arlington, VA 22209

Dear Drew Boudreau,

Enclosed is the EMC Wireless test report for compliance testing of the System Planning Corporation, GlobalStrap as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 15, Subpart B, ICES-003, Issue 4 February 2004 for a Class B Digital Device and FCC Part 15 Subpart C, RSS-210, Issue 7, June 2007 for Intentional Radiators.

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

Sincerely yours,  
MET LABORATORIES, INC.

Jennifer Warnell  
Documentation Department

Reference: (\System Planning Corporation\EMC26078-FCC247)

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## Electromagnetic Compatibility Criteria Test Report

for the

**System Planning Corporation  
Model GlobalStrap**

**Tested under**  
the FCC Certification Rules  
contained in  
Title 47 of the CFR, Parts 15 Subpart B & ICES-003  
for Class B Digital Devices  
&  
15.247 Subpart C & RSS-210, Issue 7, June 2007  
for Intentional Radiators

**MET Report: EMC26078-FCC247**

May 20, 2009

**Prepared For:**

**System Planning Corporation  
1000 Wilson Blvd.  
Arlington, VA 22209**

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

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for Class B Digital Devices  
&  
15.247 Subpart C & RSS-210, Issue 7, June 2007  
for Intentional Radiators



Len Knight, 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 the FCC Rules Parts 15B, 15.247 and Industry Canada standards ICES-003, Issue 4 February 2004, 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	May 20, 2009	Initial Issue.

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## List of Terms and Abbreviations

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



System Planning Corporation  
GlobalStrap

Electromagnetic Compatibility  
Executive Summary  
CFR Title 47, Part 15B, 15.247; RSS-210, Issue 7, June 2007 & ICES-003

## I. Executive Summary



## A. Purpose of Test

An EMC evaluation was performed to determine compliance of the System Planning Corporation GlobalStrap, 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 GlobalStrap. System Planning Corporation should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the GlobalStrap, has been **permanently** discontinued.

## B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, §15.247, in accordance with System Planning Corporation, purchase order number 57546. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference	IC Reference	Description	Compliance
47 CFR Part 15.247:2005	RSS-210 Issue 7: 2007	Applicable Standard	Compliant
47 CFR Part 15.107 (a)	RSS-210 Issue 7: 2007	Conducted Emission Limits for a Class B Digital Device	Not Applicable
47 CFR Part 15.109 (a)	RSS-210 Issue 7: 2007	Radiated Emission Limits for a Class B Digital Device	Compliant
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	Not Applicable
Title 47 of the CFR, Part 15 §15.247(a)(1)	RSS-210(A8.1)	Occupied Bandwidth	Compliant
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	Compliant
Title 47 of the CFR, Part 15; §15.247(e)	RSS-210(A8.3)	Power Spectral Density	Compliant
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



System Planning Corporation  
GlobalStrap

Electromagnetic Compatibility  
Equipment Configuration  
CFR Title 47, Part 15B, 15.247; RSS-210, Issue 7, June 2007 & ICES-003

## II. Equipment Configuration



## A. Overview

MET Laboratories, Inc. was contracted by System Planning Corporation to perform testing on the GlobalStrap, under System Planning Corporation's purchase order number 57546.

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

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

<b>Model(s) Tested:</b>	GlobalStrap	
<b>Model(s) Covered:</b>	GlobalStrap	
<b>EUT Specifications:</b>	Primary Power: 3.7 VDC	
	FCC ID: XDYGLOBALSTRAP	
	Type of Modulations:	OQPSK
	Equipment Code:	DTS
	Peak Rx Spurious:	48.4 dBuV/m@3m (4.952 GHz)
	Peak RF Output Power:	Low: 3.5 mW
		Mid: 2.5 mW
		High: 1.91 mW
	EUT Frequency Ranges:	2.405 GHz – 2.48 GHz
<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>	Len Knight	
<b>Report Date(s):</b>	May 20, 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 Licence-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment
<b>CFR 47, Part 15, Subpart B</b>	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
<b>ICES-003, Issue 4 February 2004</b>	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
<b>ANSI C63.4:2003</b>	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
<b>ANSI/NCSL Z540-1-1994</b>	Calibration Laboratories and Measuring and Test Equipment - General Requirements
<b>ANSI/ISO/IEC 17025:2000</b>	General Requirements for the Competence of Testing and Calibration Laboratories

**Table 3. References**

## C. Test Site

All testing was performed at MET Laboratories, Inc., 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 10 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

## D. Description of Test Sample

The System Planning Corporation GlobalStrap, Equipment Under Test (EUT), is designed as a security device. The unit has a special cable that plugs through it. When the cable is removed, the unit wirelessly alerts a coordinator device via ZigBee.



Photograph 1. System Planning Corporation, GlobalStrap

#### E. Equipment Configuration

Ref. ID	Name / Description	Model Number	Serial Number
14634	GLOBALSTRAP	000D6F00001188CA	14634
14633	GLOBALSTRAP	000D6F00001188CD	14633

Table 4. Equipment Configuration

#### F. Ports and Cabling Information

The EUT did not require any ports and cabling information for operation or monitoring.

#### G. Mode of Operation

For the purposes of testing, the EUT was placed in a continuous transmit mode. Three channels, Low, Mid, and High, were evaluated.



## H. 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.

## I. Disposition of EUT

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



System Planning Corporation  
GlobalStrap

Electromagnetic Compatibility  
Unintentional Radiators  
CFR Title 47, Part 15B, 15.247; RSS-210, Issue 7, June 2007 & ICES-003

### III. Electromagnetic Compatibility Criteria for Unintentional Radiators



## Electromagnetic Compatibility Criteria

### § 15.107 Conducted Emissions Limits

**Test Requirement(s):** **15.107 (a)** Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 5. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

**15.107 (b)** For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 5. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

Frequency range (MHz)	Class A Conducted Limits (dB $\mu$ V)		*Class B Conducted Limits (dB $\mu$ V)	
	Quasi-Peak	Average	Quasi-Peak	Average
* 0.15- 0.45	79	66	66 - 56	56 - 46
0.45 - 0.5	79	66	56	46
0.5 - 30	73	60	60	50

Note 1 — The lower limit shall apply at the transition frequencies.  
Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz.  
\* -- Limits per Subsection 15.207(a).

**Table 5. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15  
Subsections 15.107(a) (b) and 15.207(a)**

**Test Results:** The Class B requirement(s) of this section were not applicable with the EUT. The EUT is DC Powered.



## Radiated Emission Limits

### § 15.109 Radiated Emissions Limits

**Test Requirement(s):** **15.109 (a)** Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the Class B limits expressed in Table 6.

**15.109 (b)** The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the Class A limits expressed in Table 6.

Frequency (MHz)	Field Strength (dB $\mu$ V/m)	
	§15.109 (b), Class A Limit (dB $\mu$ V/m) @ 10m	§15.109 (a), Class B Limit (dB $\mu$ V/m) @ 3m
30 - 88	39.00	40.00
88 - 216	43.50	43.50
216 - 960	46.40	46.00
Above 960	49.50	54.00

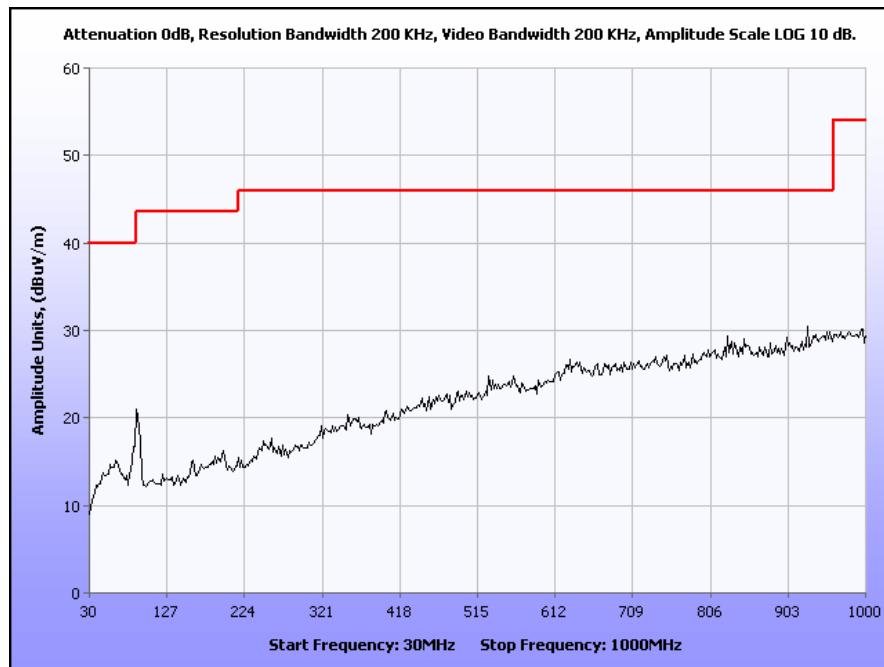
**Table 6. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b)**

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

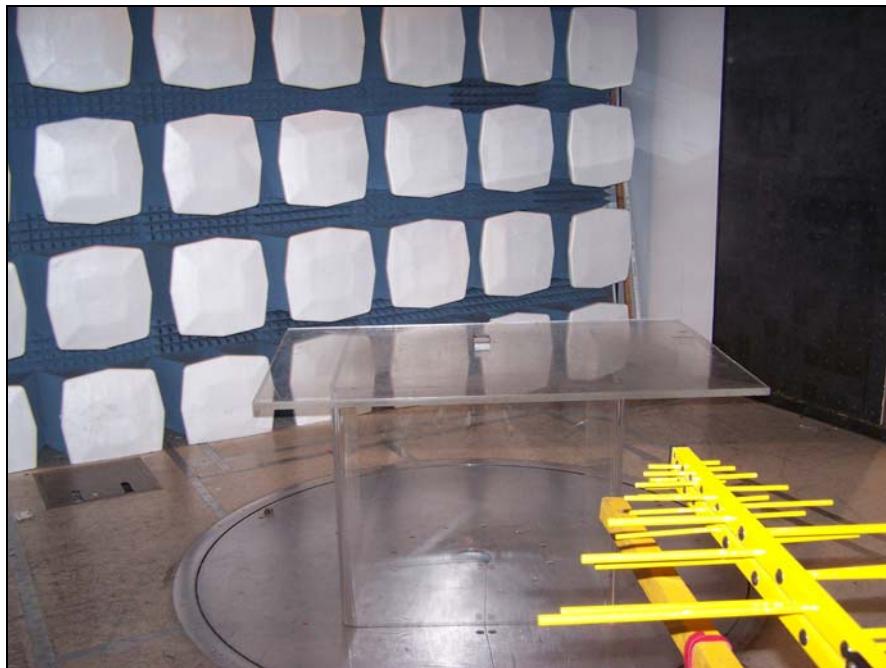
**Test Results:** The EUT was compliant with the Class B requirement(s) of this section. For the purposes of this testing, the EUT was placed in its Rx mode. A plot was taken which is corrected for both antenna correction factor and cable loss. Since no emissions in the plot were within 10 dB of the limit, no further measurements were performed.

**Test Engineer(s):** Len Knight

**Test Date(s):** 04/21/09



Plot 1. Radiated Emissions, Pre-Scan



Photograph 2. Radiated Emission Test Setup 30 MHz - 1 GHz



System Planning Corporation  
GlobalStrap

Electromagnetic Compatibility  
Intentional Radiators  
CFR Title 47, Part 15B, 15.247; RSS-210, Issue 7, June 2007 & ICES-003

## IV. Electromagnetic Compatibility Criteria for Intentional Radiators



## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.203 Antenna Requirement

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

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

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

**Results:** The EUT as tested is compliant the criteria of §15.203 by virtue of the antenna being an Integral Folded F Antenna.

**Test Engineer(s):** Len Knight

**Test Date(s):** 04/20/09



## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.207 Conducted Emissions Limits

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

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

**Table 7. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)**

**Test Results:** The requirements of this section were not applicable with the EUT. The EUT is DC Powered.



## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(a) 6 dB and 99% Bandwidth

**Test Requirements:** **§ 15.247(a):** Operation under the provisions of this section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

For systems using digital modulation techniques, the EUT may operate in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

**Test Procedure:** The transmitter was on and transmitting at the highest output power. Because the EUT contained an integral antenna, measurements were performed radiated. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately 1% of the total emission bandwidth,  $VBW > RBW$ . The 6 dB Bandwidth was measured and recorded. The measurements were performed on the low, mid and high channels.

**Test Results** The EUT was compliant with § 15.247 (a).

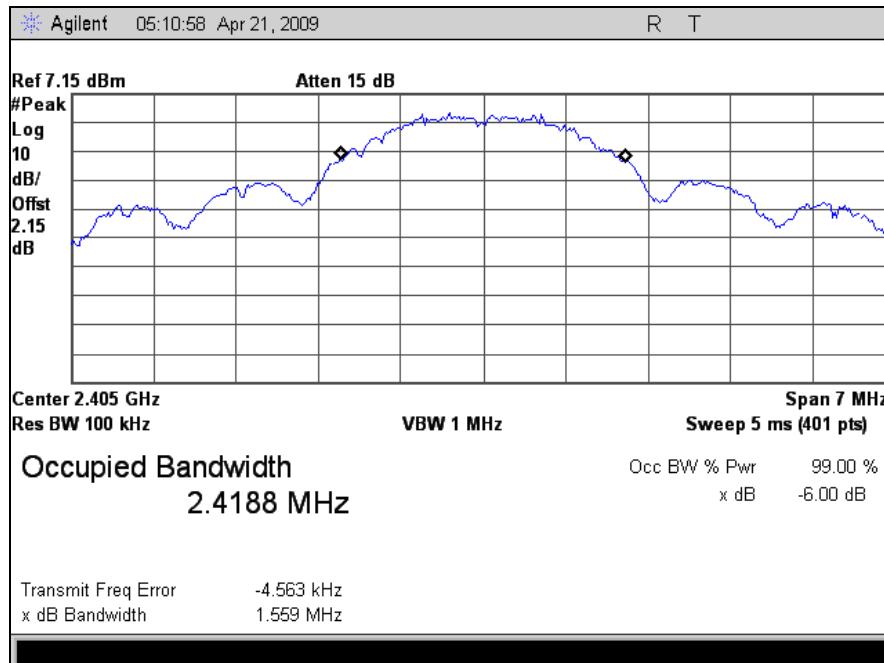
The 6 dB and 99% Bandwidth was determined from the plots on the following pages.

**Test Engineer(s):** Len Knight

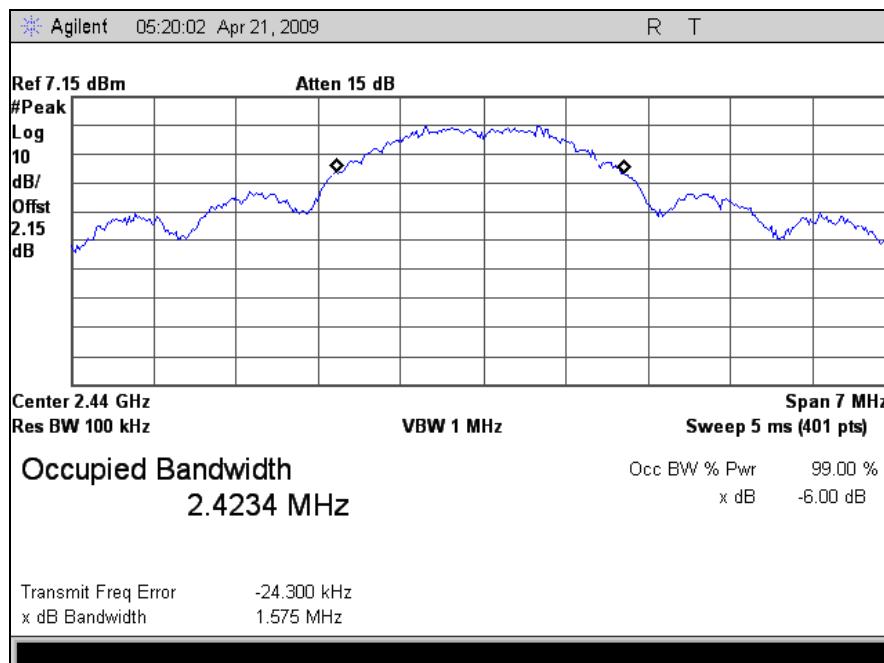
**Test Date(s):** 04/22/09

Mode Tested	Band	Channel	Frequency (GHz)	Measured 6 dB Bandwidth (MHz)	Test Limit (kHz)
Continuous Transmit	LOW	11	2.405	1.559	>=500
	MID	18	2.44	1.575	>=500
	HIGH	26	2.48	1.574	>=500

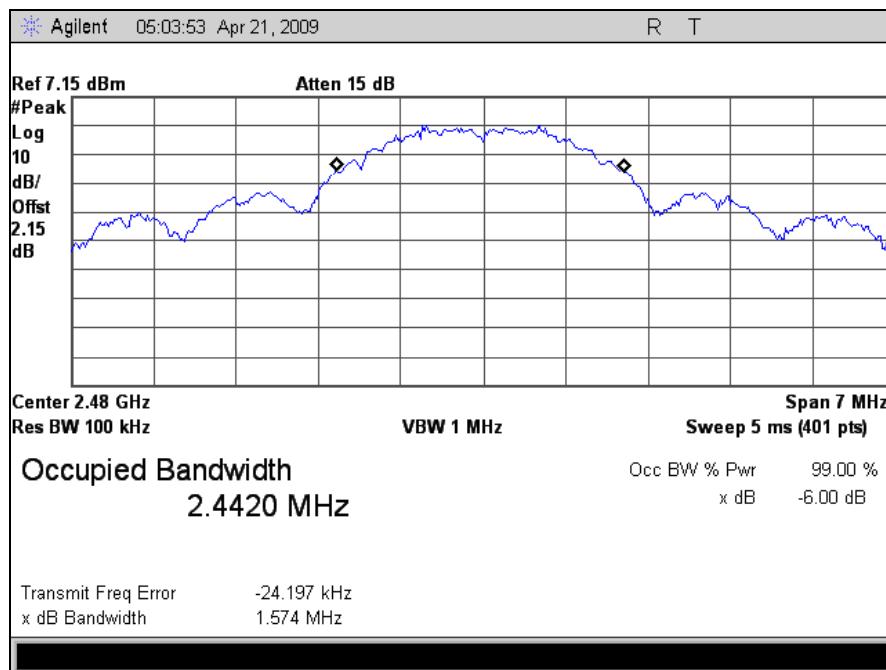
## Electromagnetic Compatibility Criteria for Intentional Radiators



Plot 2. Occupied Band Width, Low Channel, 6 dB



Plot 3. Occupied Band Width, Mid Channel, 6 dB



Plot 4. Occupied Band Width, High Channel, 6 dB



## 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 8. 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 8, 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, omnidirectional 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.

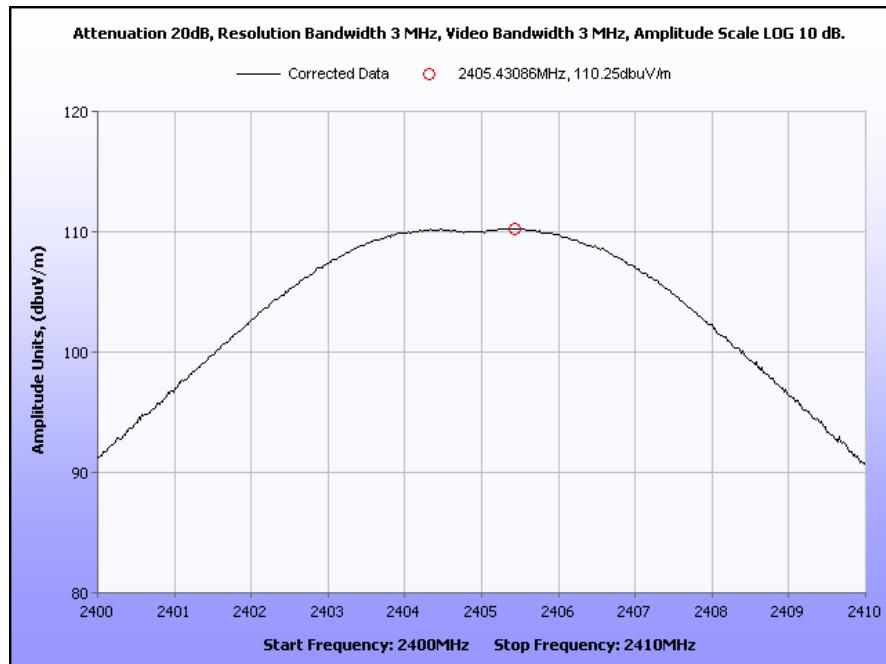
**Test Procedure:** Since the EUT had an integral antenna, conducted measurements could not be performed. Peak Power Output was deducted by way of a calculated EIRP. An antenna was located 1 m away from the EUT and plots were taken. The EUT was rotated through all three orthogonal axis. The plots were corrected for both antenna correction factor and cable loss.

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

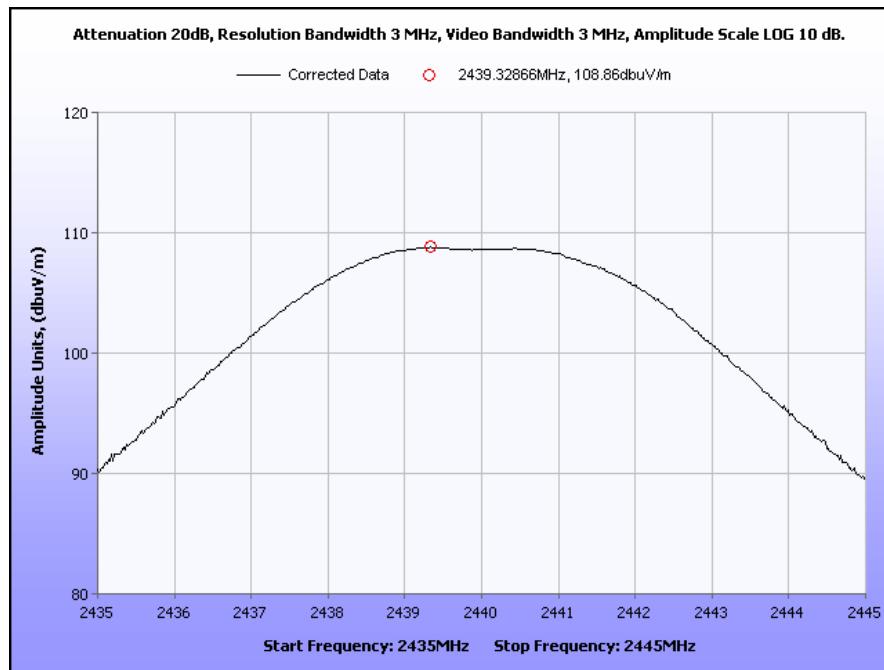
**Test Engineer(s):** Len Knight

**Test Date(s):** 04/28/09

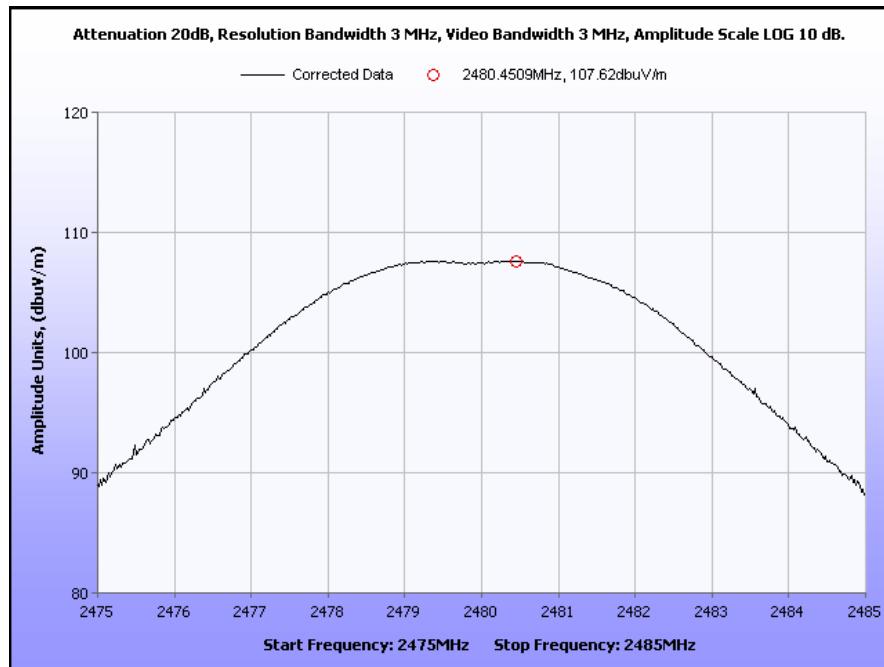
Mode Tested	Band	Channel	Frequency (GHz)	Measured Peak Radiated (dBuV/m) @ 1m	Calculated EIRP (dBm)
Continuous Transmit	LOW	11	2405	110.25	5.45
	MID	18	2440	108.86	4.06
	HIGH	26	2.48	107.62	2.82
EIRP = $E_o + 20\log D - 104.8$					



Plot 5. Peak Output Power, Low Channel



**Plot 6. Peak Output Power, Mid Channel**



**Plot 7. 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 @ 2400-2483.5 MHz; highest EIRP = 5.45 dBm (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm<sup>2</sup> or 10 W/m<sup>2</sup>**

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

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

where, S = Power Density (1 mW/cm<sup>2</sup>)

P = Power Input to antenna

G = Antenna Gain

R = 20 cm

EIRP = 3.507mW

$$S = 3.507/4\pi(20)^2$$

$$S = 0.000698 \text{ mW/cm}^2$$

**Test Engineer(s):** Len Knight

**Test Date(s):** 04/28/09



## Electromagnetic Compatibility Criteria for Intentional Radiators

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

**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 9. 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 10.

Frequency (MHz)	§ 15.209(a), Radiated Emission Limits (dB $\mu$ V/m) @ 3m
30 - 88	40.00
88 - 216	43.50
216 - 960	46.00
Above 960	54.00

**Table 10. Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a)**

**Test Procedures:** For the purposes of testing, the EUT transmitted on the Low, Mid, and High channel. The EUT was rotated through all three orthogonal axes. Plots shown are corrected for antenna correction factor, cable loss, pre-amp gain and distance.

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

**Test Engineer(s):** Len Knight

**Test Date(s):** 04/22/09



## Harmonic Emissions Requirements – Radiated

Frequency (MHz)	Antenna Polarity (H/V)	EUT Field Strength Final Amp. (dB $\mu$ V/m)	Limit @ 3m (dB $\mu$ V/m)	Margin (dB)	Remark
4810	V	56.1	74	17.9	Peak
4810	V	48.95	54	5.1	Average
7215	V	55.04	74	19.0	Peak
7215	V	45.24	54	8.8	Average

Table 11. Radiated Harmonic Emissions, Low Channel

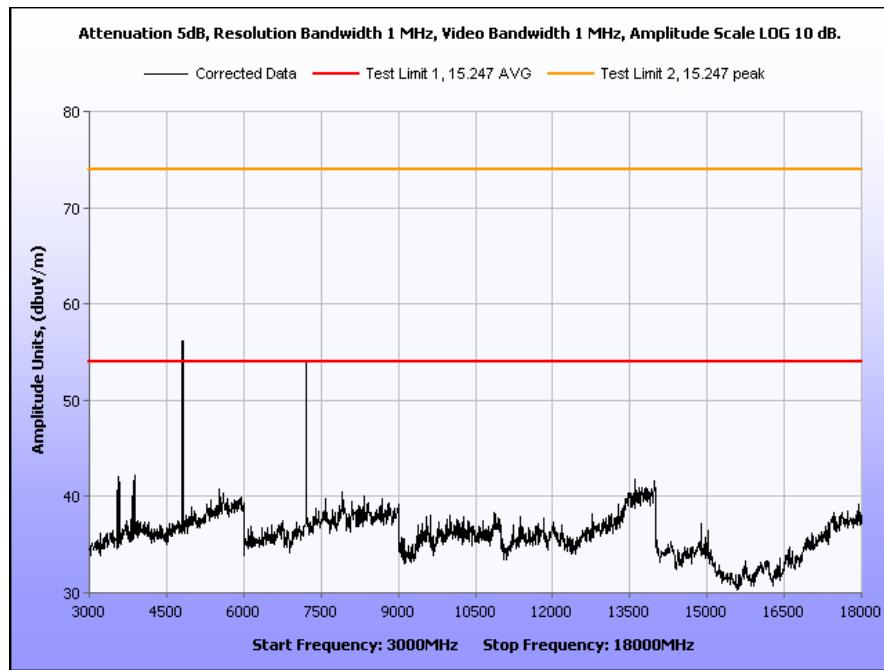
Frequency (MHz)	Antenna Polarity (H/V)	EUT Field Strength Final Amp. (dB $\mu$ V/m)	Limit @ 3m (dB $\mu$ V/m)	Margin (dB)	Remark
4880	V	55.78	74	18.2	Peak
4880	V	47.75	54	6.3	Average
7320	V	48.91	74	25.1	Peak
7320	V	38.46	54	15.5	Average

Table 12. Radiated Harmonic Emissions, Mid Channel

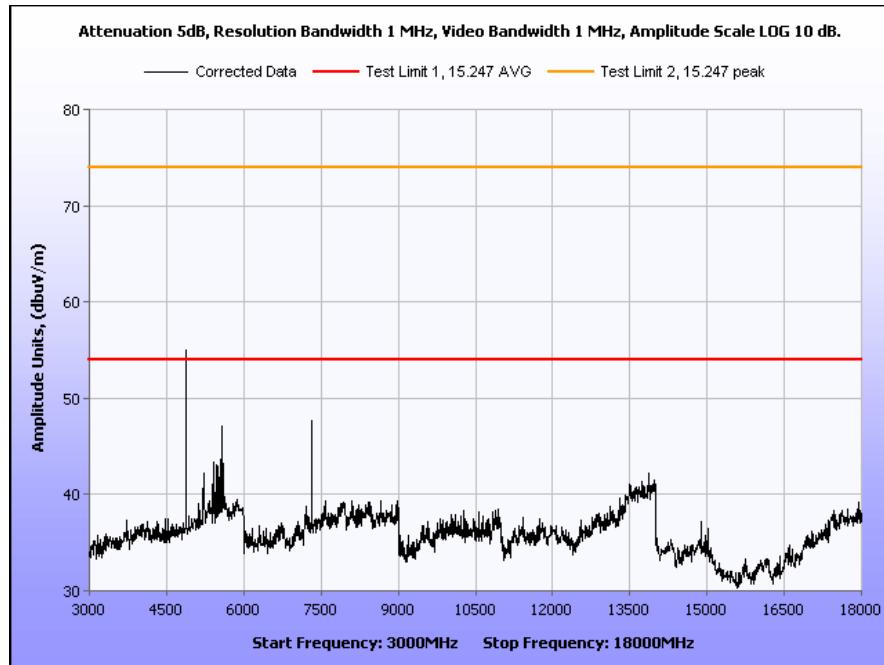
Frequency (MHz)	Antenna Polarity (H/V)	EUT Field Strength Final Amp. (dB $\mu$ V/m)	Limit @ 3m (dB $\mu$ V/m)	Margin (dB)	Remark
4960	V	53	74	21.0	Peak
4960	V	44.43	54	9.6	Average
7440	V	45.67	74	28.3	Peak
7440	V	35.81	54	18.2	Average

Table 13. Radiated Harmonic Emissions, High Channel

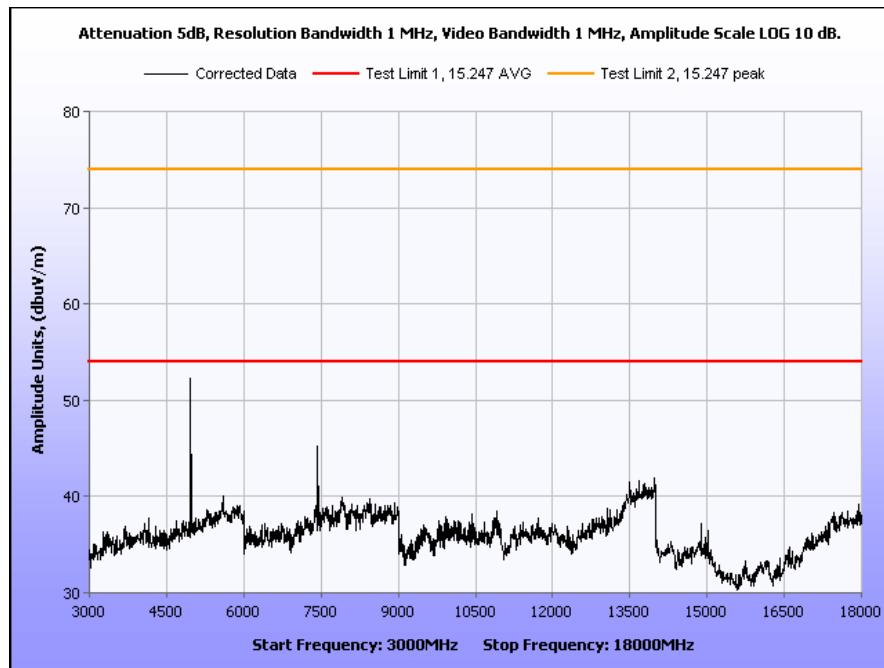
Note: All other emissions were below the noise floor of the measurement system.



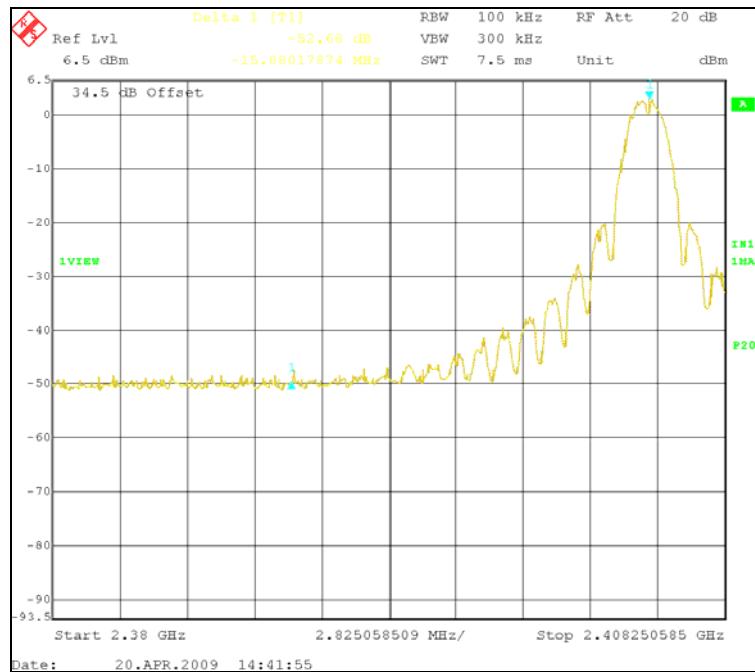
Plot 8. Radiated Harmonic Emissions, Low Channel



Plot 9. Radiated Harmonic Emissions, Mid Channel



Plot 10. Radiated Harmonic Emissions, High Channel

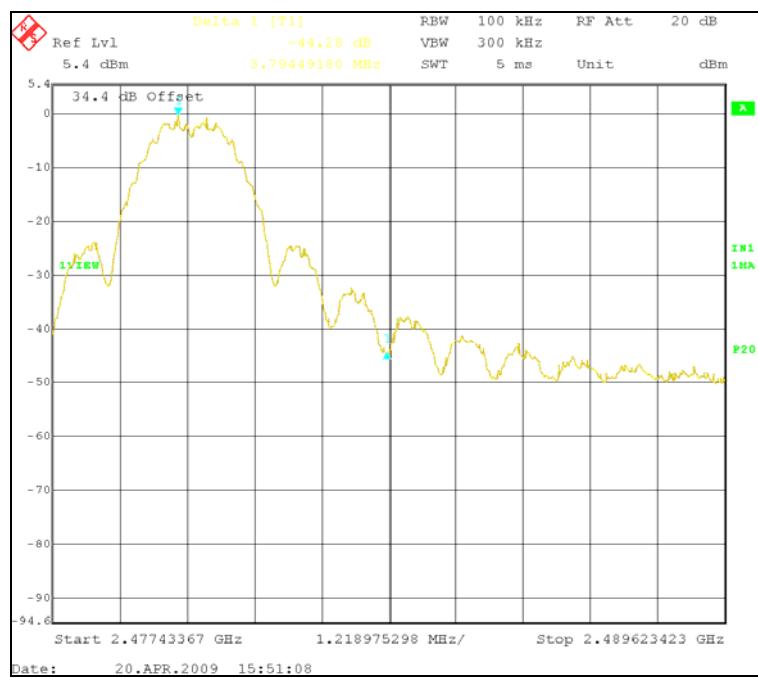


Plot 11. Conducted Spurious Emissions, Lower Band, 30 dBc



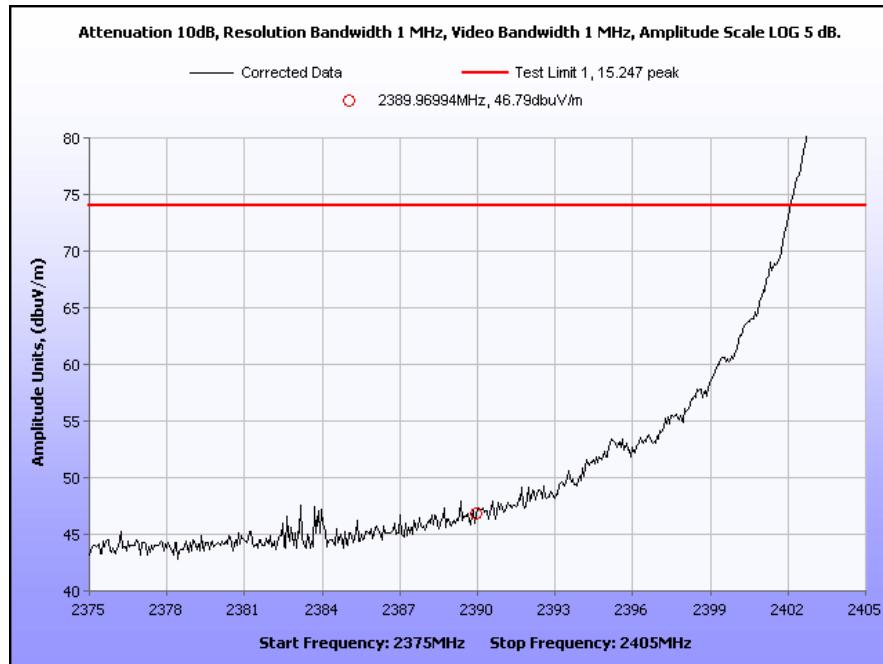
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CFR Title 47, Part 15B, 15.247; RSS-210, Issue 7, June 2007 & ICES-003

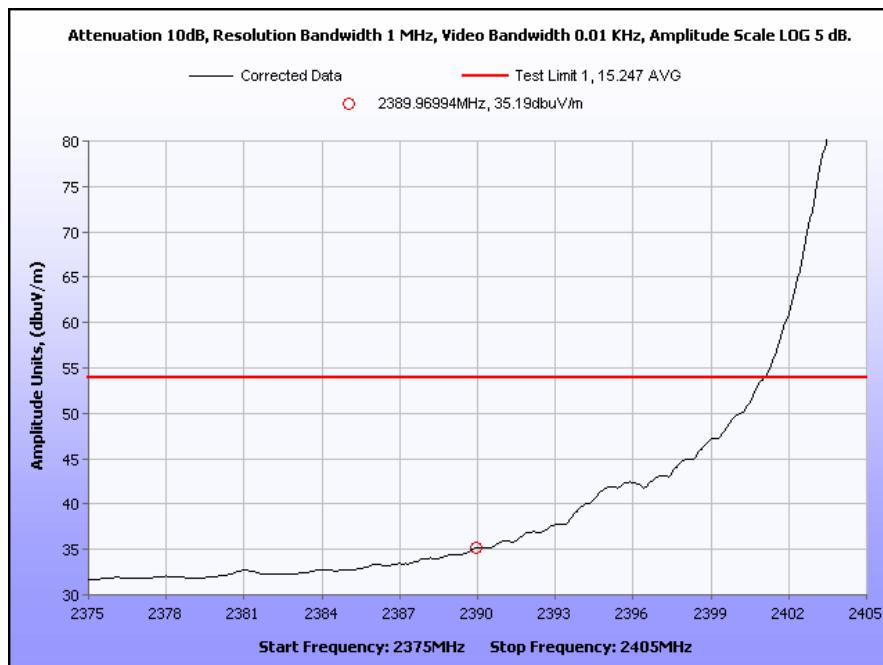


Plot 12. Conducted Spurious Emissions, Upper Band, 30 dBc

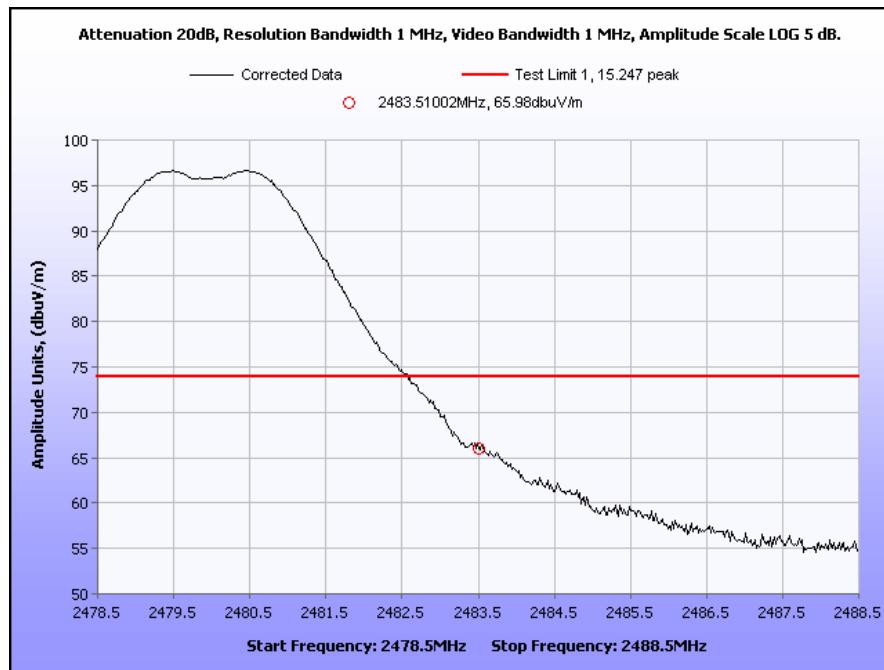
## Radiated Band Edge Measurements



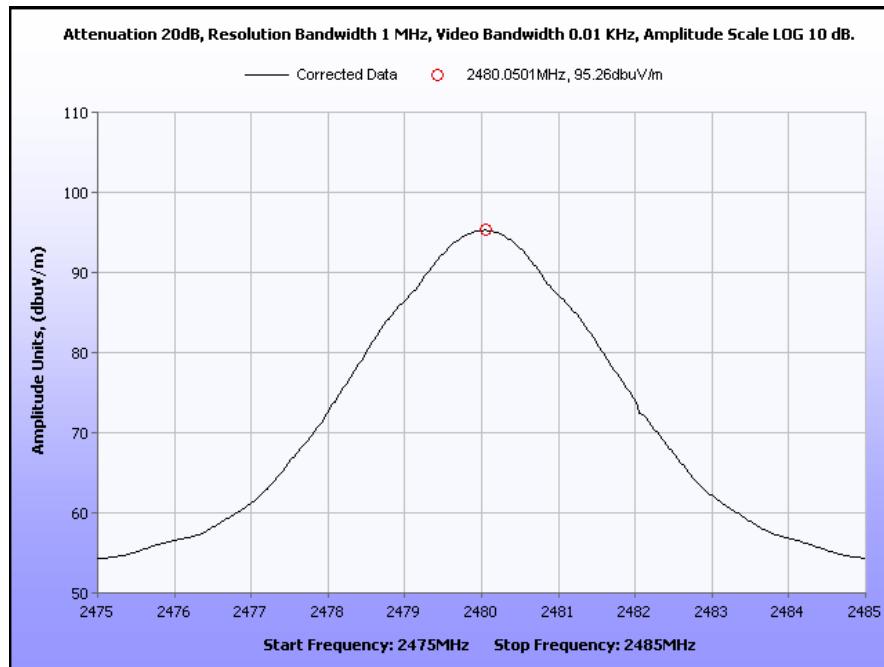
Plot 13. Lower Band Edge, Peak



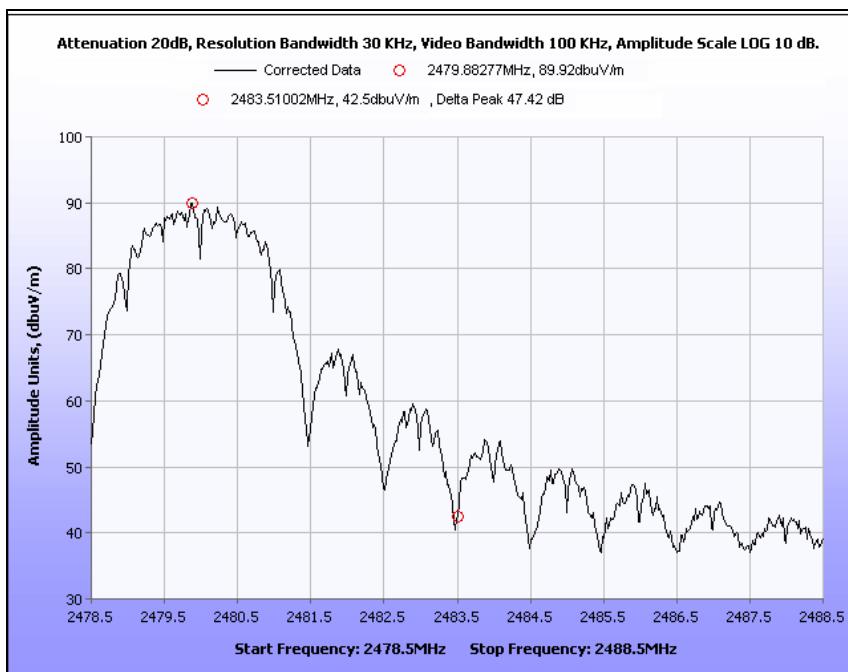
Plot 14. Lower Band Edge, Average



Plot 15. Upper Band Edge, Peak



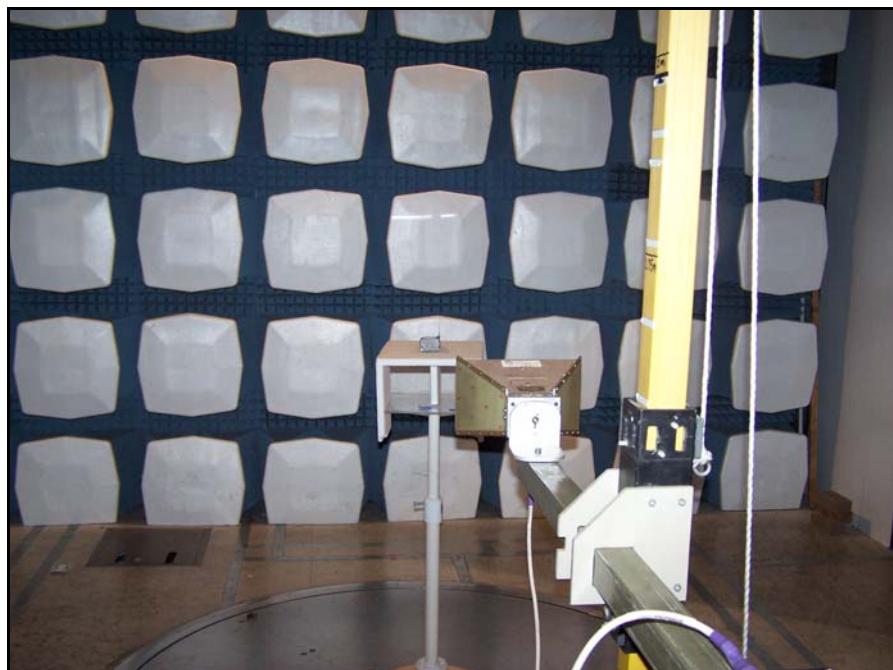
Plot 16. Peak Value of Fundamental, Upper Band Edge



**Plot 17. Band Edge, Upper Channel for Delta Marker Method**

Emission	Corrected Amplitude (dBuV/m)	Delta Method (dB)	Band Edge Measurement (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Average	95.26	-47.42	47.84	54	6.16

**Table 14. Upper Band Edge, Test Results, Delta Marker Method**



Photograph 3. Test Equipment and Setup for Various Radiated Measurements



## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(d) Spurious Emissions Requirements –RF Conducted

**Test Requirement:** **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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

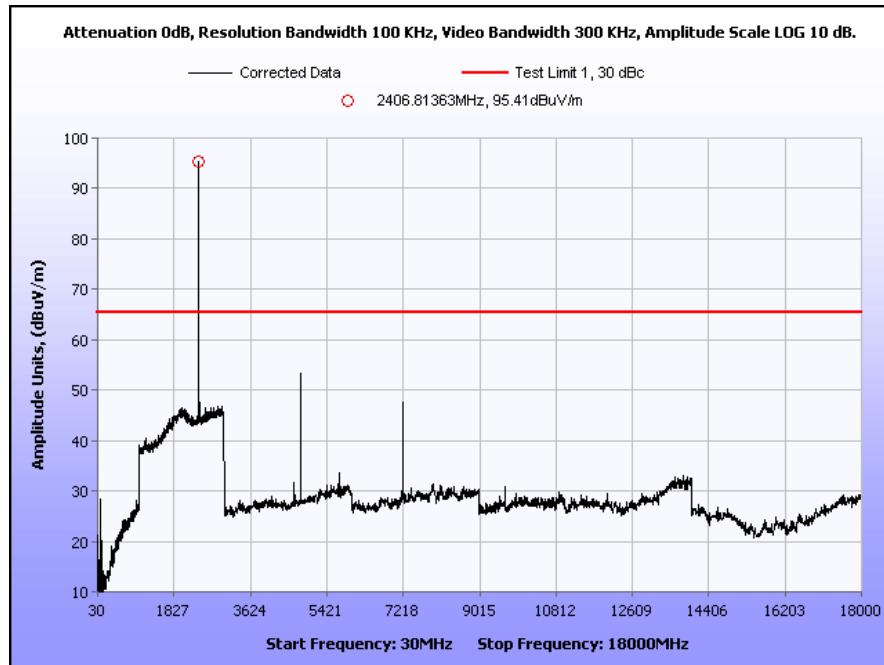
**Test Procedure:** For intentional radiators with a digital device portion which operates below 10 GHz, the spectrum was investigated as per §15.33(a)(1) and §15.33(a)(4); i.e., the lowest RF signal generated or used in the device up to the 10<sup>th</sup> harmonic of the highest fundamental frequency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

Since the EUT had an integral antenna, conducted measurements could not be performed. Measurements needed to be taken radiated. An antenna was located 3 m away from the EUT and plots were taken. The EUT was rotated through all three orthogonal axes. The plots were corrected for both antenna correction factor and cable loss.

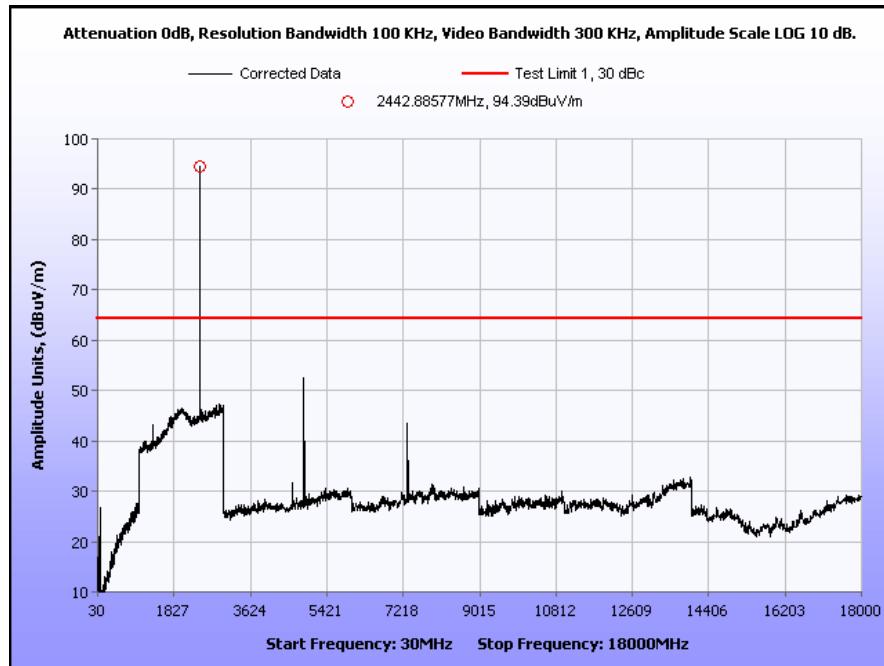
**Test Results:** The EUT was compliant with the Spurious Emissions Requirements of **§ 15.247 (d)**.

**Test Engineer(s):** Len Knight

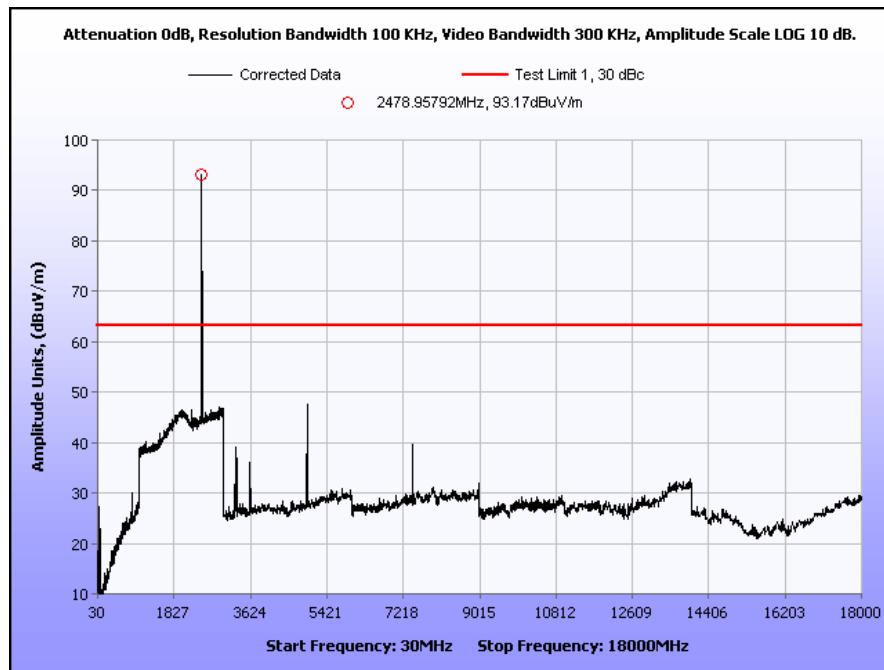
**Test Date(s):** 04/22/09



**Plot 18. Conducted Emissions, Low Channel, 30 MHz – 18 GHz**



**Plot 19. Conducted Emissions, Mid Channel, 30 MHz – 18 GHz**



Plot 20. Conducted Emissions, High Channel, 30 MHz – 18 GHz



## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(e) Peak Power Spectral Density

**Test Requirements:** **§15.247(e):** For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

**Test Procedure:** Since the EUT had an integral antenna, conducted measurements could not be preformed. Peak Power Spectral Density was deducted by a way of Radiated Measurements. An antenna was located 1 m away from the EUT and plots were taken. The EUT was rotated through all three orthogonal axes. The plots were corrected for both antenna correction factor and cable loss. The power level of the EUT was set to the maximum level.  
RBW = 3 kHz, VBW>RBW  
Sweep = Span/ 3 kHz

**Test Results:** The EUT was compliant with the peak power spectral density limits of **§ 15.247 (e)**.

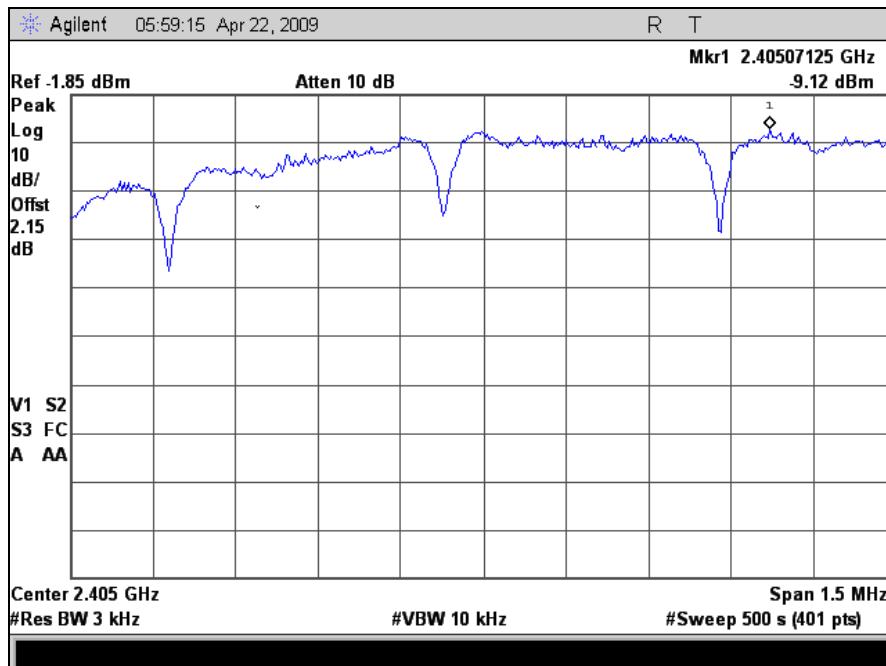
The peak power spectral density was determined from plots on the following page(s).

**Test Engineer:** Len Knight

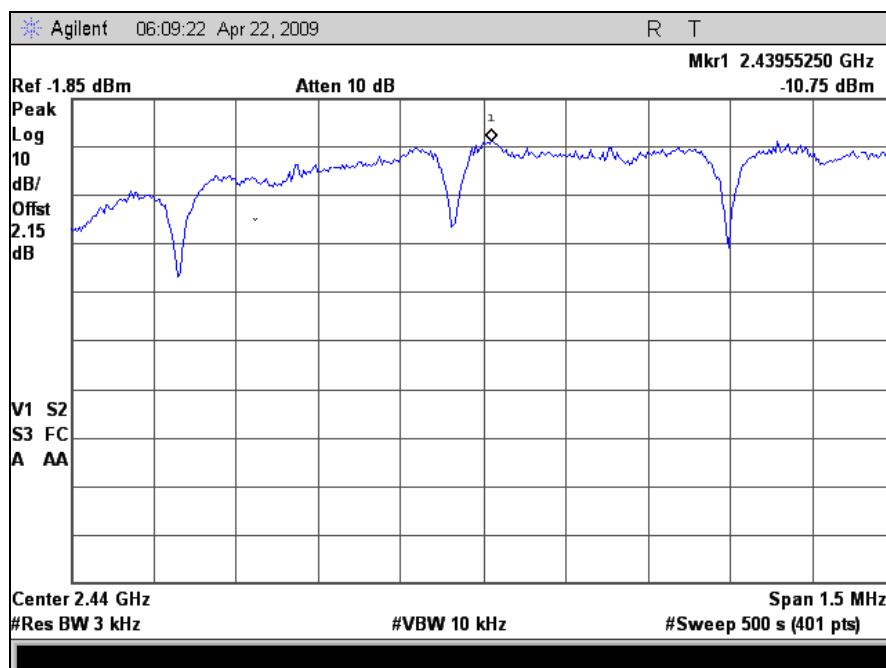
**Test Date:** 04/22/09

Mode Tested	Band	Channel	Measured PPSD (dBm)	Test Limit (dBm)
Continuous Transmit	LOW	11	-9.12	8
	MID	18	-10.75	8
	HIGH	26	-12.69	8

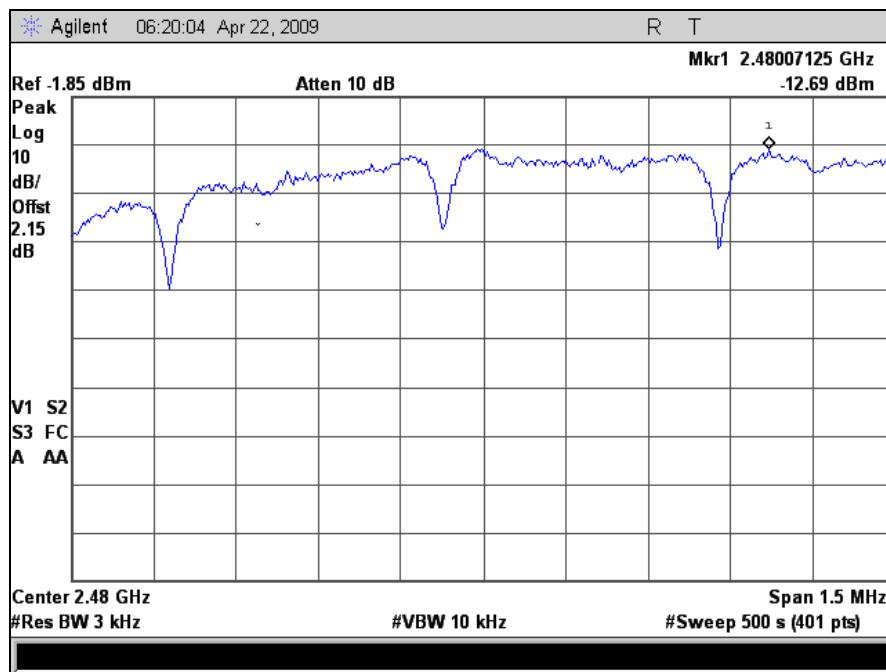
## Peak Power Spectral Density



Plot 21. Peak Power Spectral Density, Low Channel



Plot 22. Peak Power Spectral Density, Mid Channel



Plot 23. Peak Power Spectral Density, High Channel



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## 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	02/17/2006	05/22/2009
1T4592	RF FILTER KIT	VARIOUS	N/A		SEE NOTE
1T4303	ANTENNA; BILOG	SCHAFNER - CHASE EMC	CBL6140A	07/07/2008	07/07/2009
1T2511	ANTENNA; HORN	EMCO	3115	07/29/2008	07/29/2009
1T4612	ESA-E SERIES SPECTRUM ANALYZER	AGILENT	E4407B	02/17/2009	02/17/2010
1T4442	PRE-AMPLIFIER, MICROWAVE	MITEQ	AFS42-01001800-30-10P		SEE NOTE
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	04/18/2008	04/25/2009
1T4568	RADIATING NOISE SOURCE	MET LABORATORIES	N/A		SEE NOTE
1T4632	THERMO/HYGROMETER	CONTROL COMPANY	S6-627-9	09/25/2007	09/25/2009

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.

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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

### Label and User's Manual Information

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

#### § 15.19 Labeling requirements.

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

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

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

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

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

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

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

(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.

(5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

#### § 15.21 Information to user.

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

## Verification & User's Manual Information

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

### § 15.105 Information to the user.

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

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

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

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

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

## ICES-003 Procedural & Labeling Requirements

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

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

### Procedural Requirements:

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

Section 6.1: A record of the measurements and results, showing the date that the measurements were completed, shall be retained by the manufacturer or importer for a period of at least five years from the date shown in the record and made available for examination on the request of the Minister.

Section 6.2: A written notice indicating compliance must accompany each unit of digital apparatus to the end user. The notice shall be in the form of a label that is affixed to the apparatus. Where because of insufficient space or other constraints it is not feasible to affix a label to the apparatus, the notice may be in the form of a statement in the user's manual.

### Labeling Requirements:

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

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

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

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

# End of Report