



**MET Laboratories, Inc.** *Safety Certification - EMI - Telecom Environmental Simulation*

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March 8, 2007

Outsite Networks, Inc.  
4855 Brookside Court  
Norfolk, VA 23502

Dear Benjamin Raydo,

Enclosed is the EMC test report for compliance testing of the Outsite Networks, Inc., Touchpoint IAD02 as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-03 ed.), Part 15, Subpart C.

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.

Samantha Sharbonda  
Documentation Department

Reference: (\\Outsite Networks, Inc.\\EMC21023-FCC247)

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Outsite Networks, Inc.  
Touchpoint IAD02

CFR Title 47, Part 15, Subpart C

## **Electromagnetic Compatibility Test Report**

for the

**Outsite Networks, Inc.  
Touchpoint IAD02**

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

**MET Report: EMC21023-FCC247**

March 8, 2007

**Prepared For:**

**Outsite Networks, Inc.  
4855 Brookside Court  
Norfolk, VA 23502**

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



Outsite Networks, Inc.  
Touchpoint IAD02

CFR Title 47, Part 15, Subpart C

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**Outsite Networks, Inc.**  
**Touchpoint IAD02**

### Tested Under

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

Len Knight, Project Engineer  
Electromagnetic Compatibility Lab

Samantha Sharbonda  
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.

Kevin Mehaffey, Manager  
Electromagnetic Compatibility Lab



Outsite Networks, Inc.  
Touchpoint IAD02

CFR Title 47, Part 15, Subpart C

## Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	February 1, 2007	Initial Issue.
1	March 8, 2007	Editorial Corrections per TCB Technical Request.



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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



# **I. Executive Summary**



## A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Outsite Networks, Inc., Touchpoint IAD02, 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 Touchpoint IAD02. Outsite Networks, Inc. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Touchpoint IAD02, 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 Outsite Networks, Inc., purchase order number PO-NP2519864. All tests were conducted using measurement procedure ANSI C63.4-2003.

Reference	Description	Results
Title 47 of the CFR, Part 15, Subpart C, §15.207	AC Power Line Conducted Emissions	Compliant
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(a)(2)	6dB Occupied Bandwidth	Compliant.
Title 47 of the CFR, Part 15, Subpart C, §15.247(b)(3)	Maximum Peak Conducted Output Power	Compliant
Title 47 of the CFR, Part 15, Subpart C, §15.247(d)	Spurious Radiated Emissions	Compliant
Title 47 of the CFR, Part 15, Subpart C, §15.247(e)	Peak Power Spectral Density	Compliant

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



Outsite Networks, Inc.  
Touchpoint IAD02

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

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## II. Equipment Configuration



## A. Overview

MET Laboratories, Inc. was contracted by Outsite Networks, Inc. to perform testing on the Touchpoint IAD02, under Outsite Networks, Inc.'s purchase order number PO-NP2519864.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Outsite Networks, Inc., Touchpoint IAD02.

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

<b>Model(s) Tested:</b>	Touchpoint IAD02	
<b>Model(s) Covered:</b>	Touchpoint IAD02	
<b>EUT Specifications:</b>	Primary Power: +12VDC from a 120 VAC, 60 Hz converter	
	FCC ID: U2C-FMPWR-2-3	
	Type of Modulations:	O-QPSK (802.15.4 modem) 250kbps
	Equipment Code:	DTS
	Peak RF Conducted Output Power:	19.61 dBm
	EUT TX Frequency Ranges:	2405 MHz – 2480 MHz
<b>Analysis:</b>	The results obtained relate only to the item(s) tested.	
<b>Evaluated by:</b>	Len Knight	
<b>Date(s):</b>	March 8, 2007	



## 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>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

## C. 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).

## D. Description of Test Sample

The Touchpoint IAD02, Equipment Under Test (EUT), is a wireless audio/RFID (ISO14443) terminal. It is used in retail stores to identify consumers participating in our loyalty programs. It identifies consumer by their unique ISO14443 RFID tag, which our EUT reads, and plays targeted audio messages to that consumer (i.e music/promotions/news). The EUT downloads audio and communicates consumer RFID tag info through use of a 2.4Ghz spread spectrum radio. Audio is stored locally in flash to minimize RF usage.

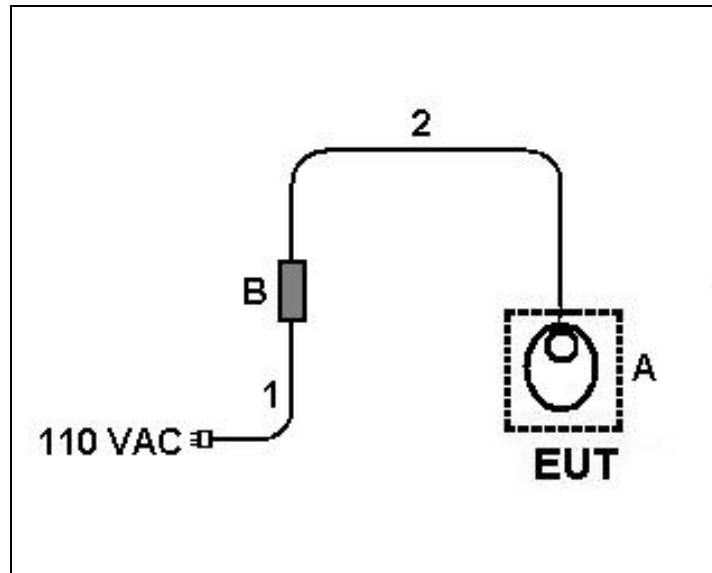


Figure 1. Block Diagram of Test Configuration (Radiated Emissions)

## E. 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	Model Number
A	Touchpoint	IAD02_R1_00000
A	Touchpoint w/SMA	IAD02_R1_00001SMA

Table 2. Equipment Configuration

## F. Support Equipment

Outside Networks, Inc. supplied support equipment necessary for the operation and testing of the Touchpoint IAD02. All support equipment supplied is listed in the following Support Equipment List.

Ref. ID	Name / Description	Manufacturer	Model Number	Serial Number
B	Power Supply for EUT	KTEC	KSAFE1200250T1M2	--

Table 3. Support Equipment



## G. Ports and Cabling Information

Ref. ID	Cable Description	Qty.	Length (m)	Shielded (Y/N)
1	18 ga., 2 cond.	1	1.8	N
2	18 ga., 2 cond.	1	2	N

Table 4. Ports and Cabling Information

## H. Mode of Operation

The EUT simulated the 2.4 GHz spread spectrum radio usage by continuously transmitting a pseudo random data stream. The EUT could also be put into a receive only mode. The EUT could also be stimulated by placing an ISO14443 RFID tag in its reader area, or by pressing buttons.

The EUT could be set to individual channels from 0 to 15.

## I. Modifications

### a) Modifications to EUT

In order to gain compliance to Band Edge Restricted, the output power had to be adjusted as follows:

Channel 0 : 0x3C  
Channels 1-11 : 0x7C  
Channel 12 : 0x4C  
Channel 13 : 0x0C  
Channel 14 : 0x08  
Channel 15 : 0x00

### b) Modifications to Test Standard

No modifications were made to the test standard.

## J. Disposition of EUT

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





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



## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.203 Antenna Requirement

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

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

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

**Results:** The antenna is an integrated PCB Inverted-F type. Because it is an integrated antenna, it meets the requirements of this section. The EUT is therefore compliant with §15.203.

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

**Test Date(s):** December 19, 2006



## 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. The first three and the last three channels were tested. 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 found compliant with the requirements of this section. In order to gain compliance to Band Edge Restricted, the output power had to be adjusted as follows:

Channel 0 : 0x3C  
Channels 1-11 : 0x7C  
Channel 12 : 0x4C  
Channel 13 : 0x0C  
Channel 14 : 0x08  
Channel 15 : 0x00

The following plots show measurements made at a 3m distance. The plots were corrected for cable loss and antenna correction factors by the capture software. The EUT was rotated about all three orthogonal axes.

**Test Engineer:** Len Knight

**Test Date:** January 10, 2007

### Band Edge Emissions – Test Results

Nearest Band Edge Frequency (GHz)	Actual Frequency Measured (GHz)	Channel of Operation	Corrected Measurement Average (dBuV/m)	Average Limit (dBuV/m)
2.390	2.390013	0	48.84	54
2.390	2.390013	1	50.22	54
2.390	2.384078	2	49.20	54
2.4835	2.483841	13	49.44	54
2.4835	2.483503	14	47.73	54
2.4835	2.483505	15	53.53	54

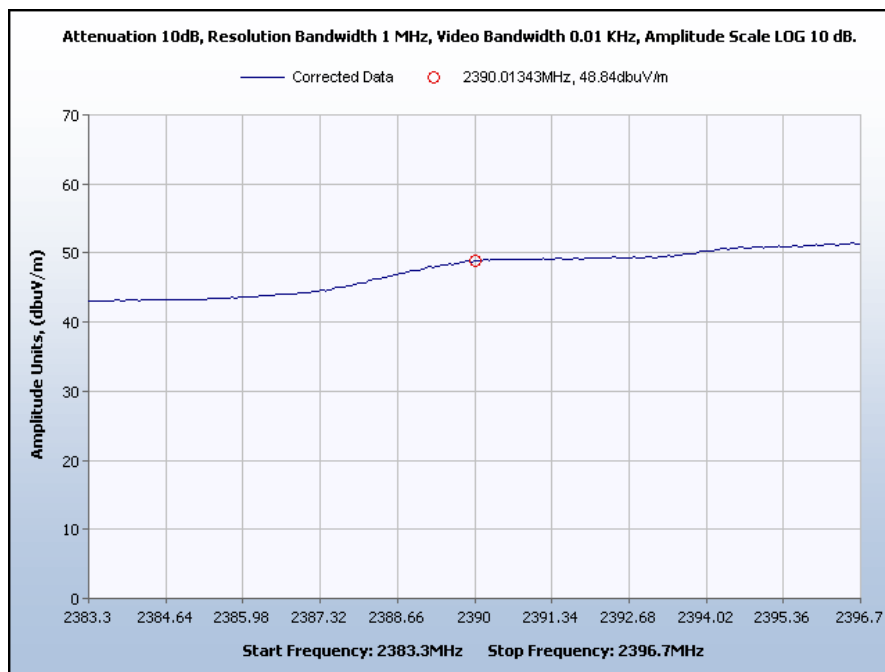
Table 6. Band Edge Average Emissions

Nearest Band Edge Frequency (GHz)	Actual Frequency Measured (GHz)	Channel of Operation	Corrected Measurement Average (dBuV/m)	Average Limit (dBuV/m)
2.390	2.389798	0	70.04	74
2.390	2.389288	1	73.48	74
2.390	2.388617	2	71.87	74
2.4835	2.483584	13	68.05	74
2.4835	2.483518	14	69.79	74
2.4835	2.483592	15	69.35	74

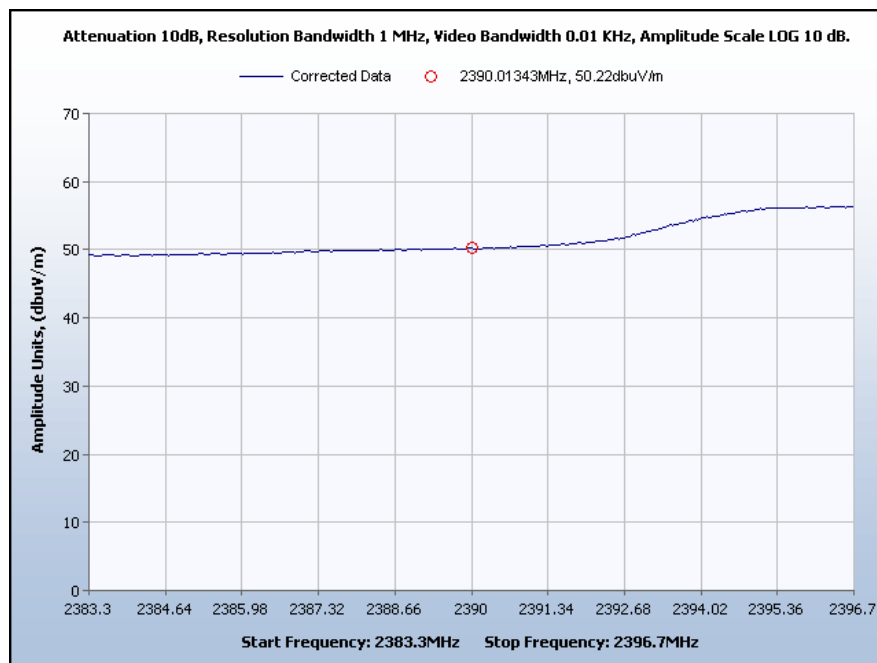
Table 7. Band Edge Peak Emissions



## Band Edge Emissions – Test Results



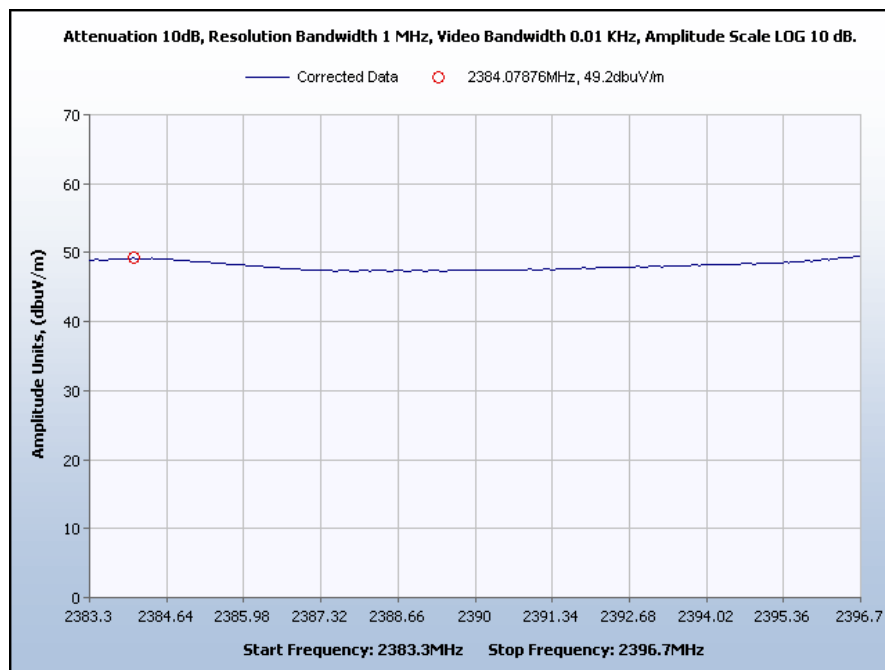
Graph 1. Band Edge Average Emissions, Channel 0



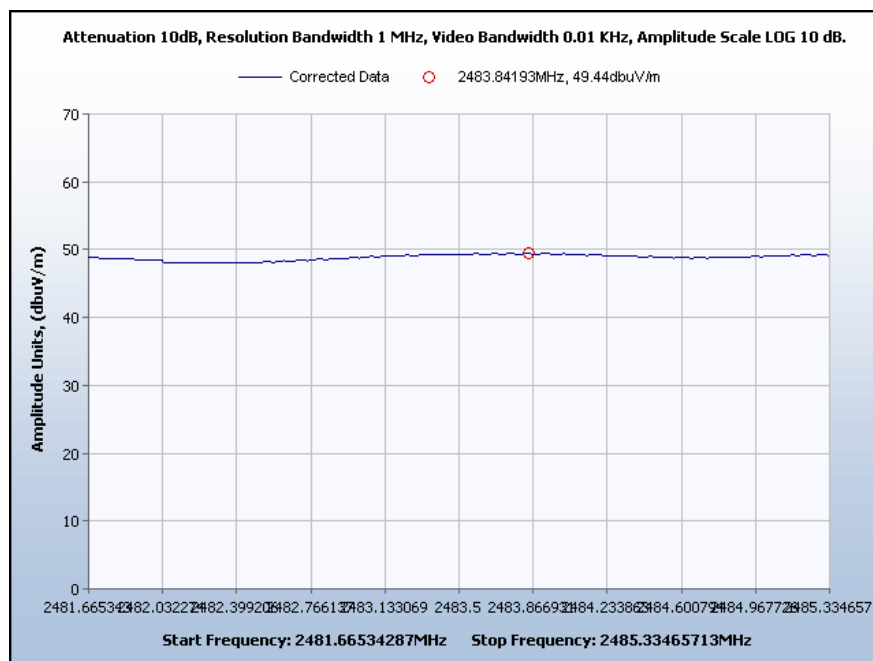
Graph 2. Band Edge Average Emissions, Channel 1



## Band Edge Emissions – Test Results



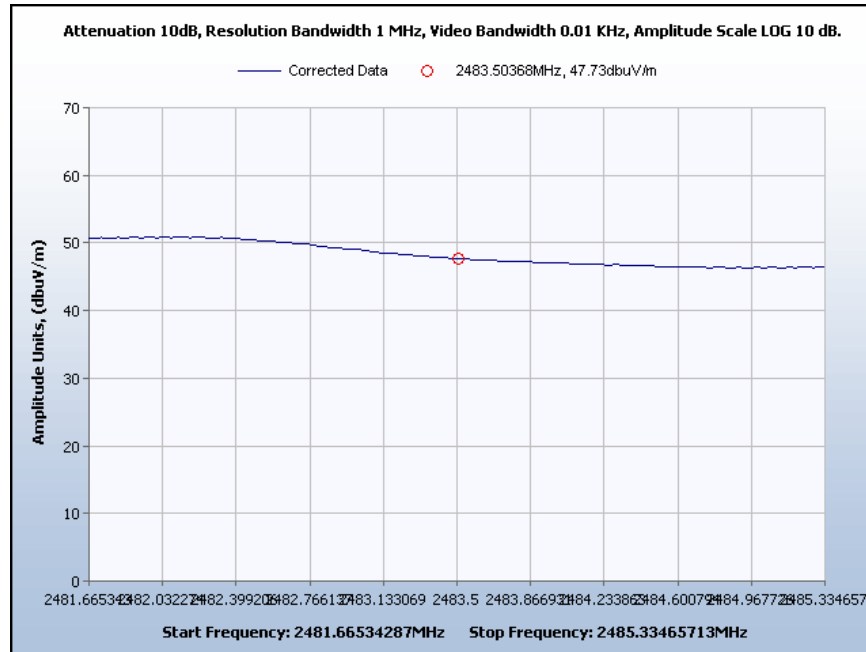
Graph 3. Band Edge Average Emissions, Channel 2



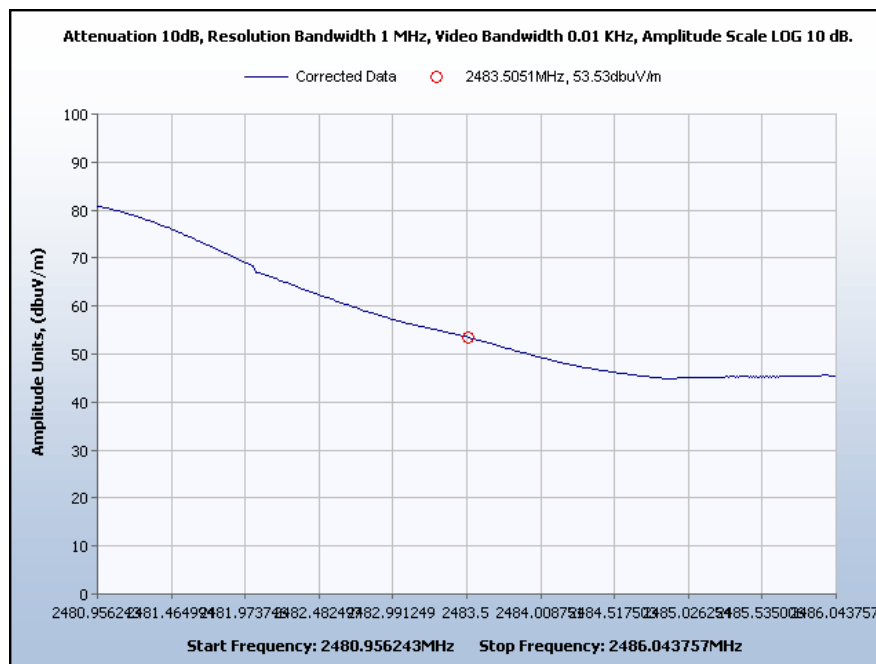
Graph 4. Band Edge Average Emissions, Channel 13



## Band Edge Emissions – Test Results



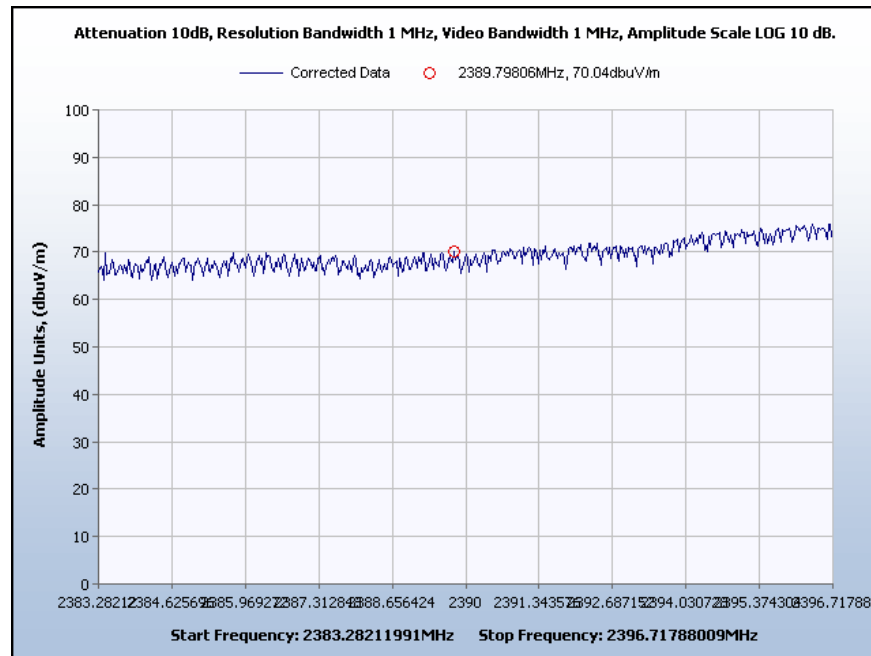
Graph 5. Band Edge Average Emissions, Channel 14



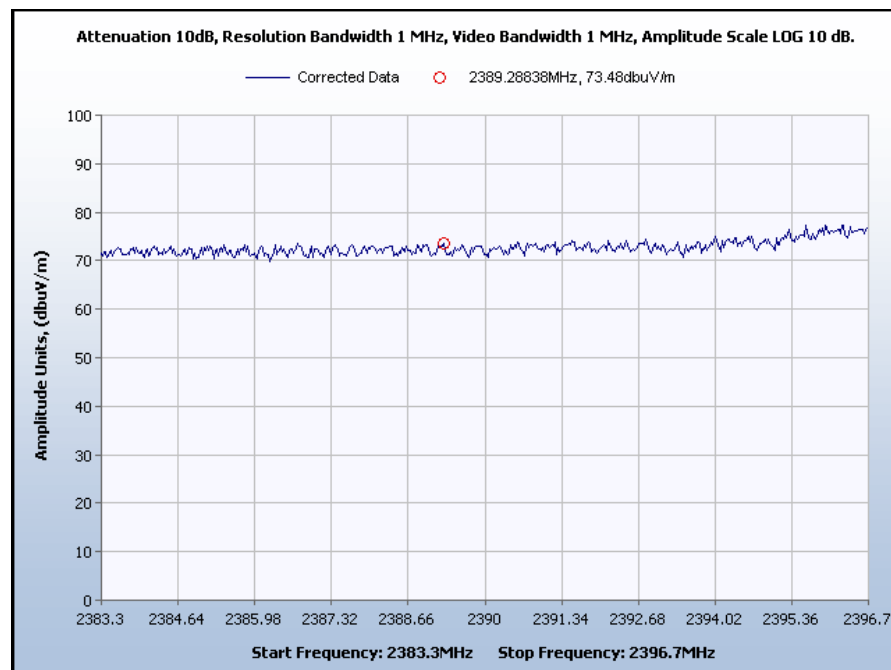
Graph 6. Band Edge Average Emissions, Channel 15



## Band Edge Emissions – Test Results



Graph 7. Band Edge Peak Emissions, Channel 0

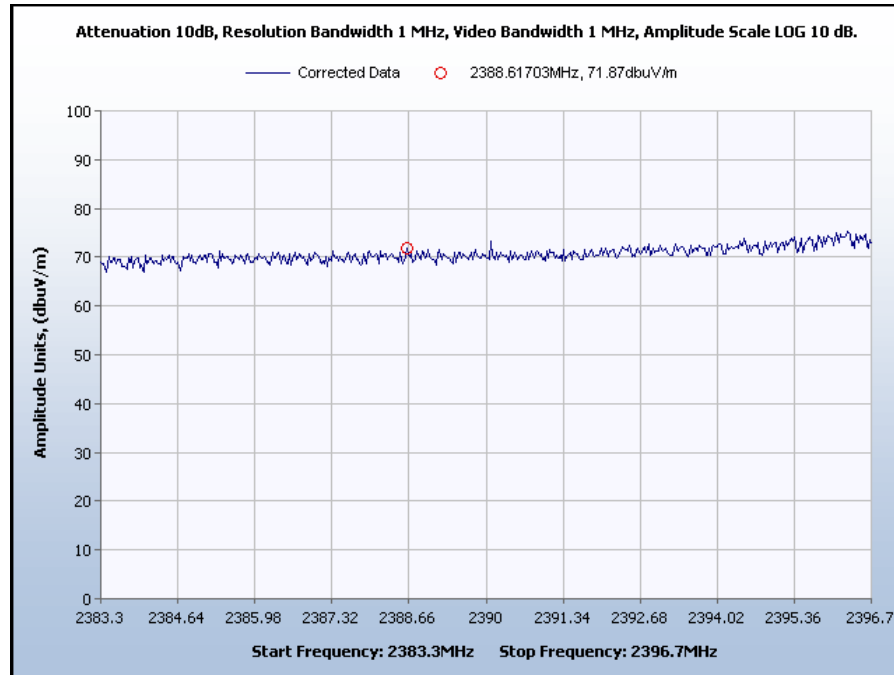


Graph 8. Band Edge Peak Emissions, Channel 1

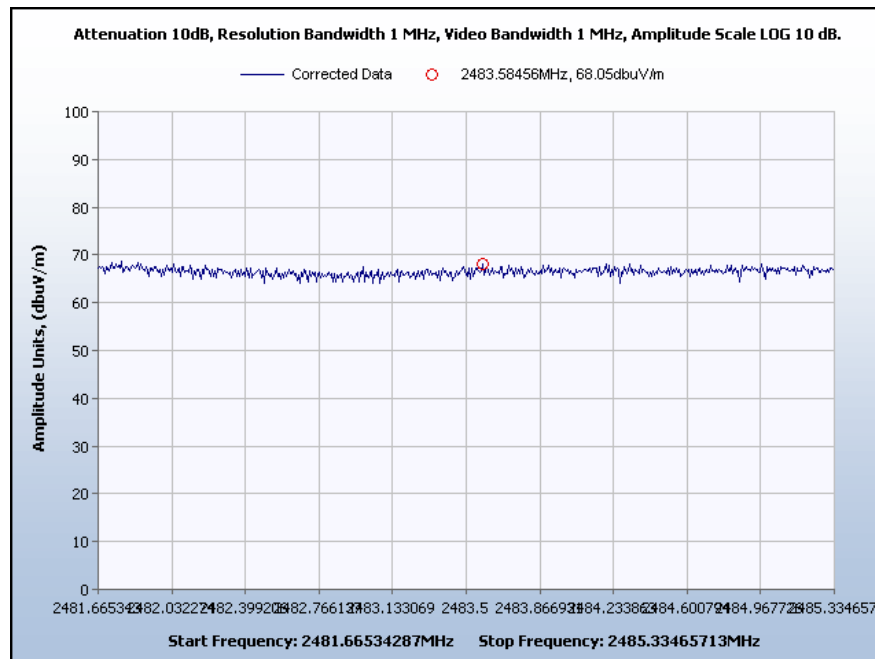




## Band Edge Emissions – Test Results



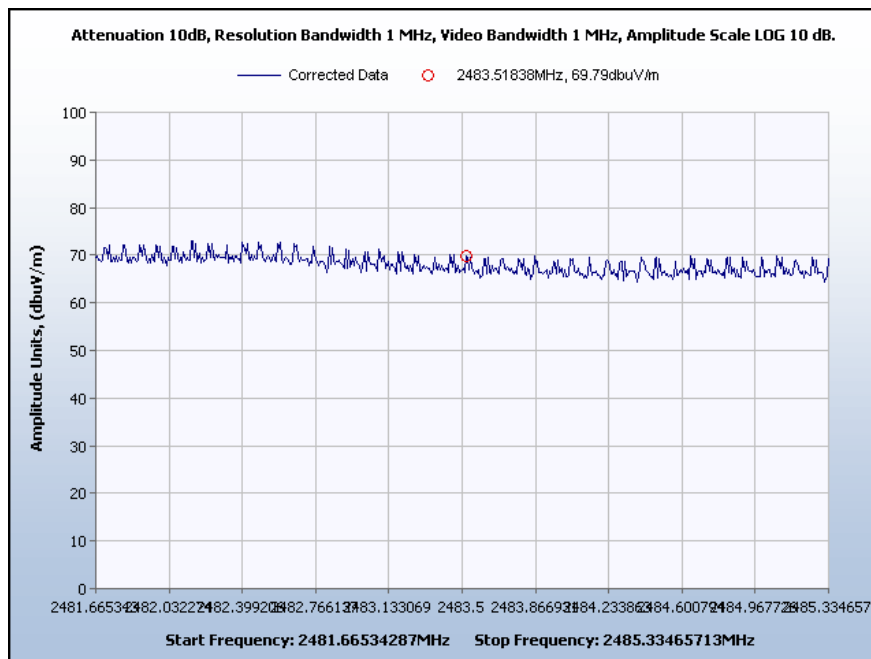
Graph 9. Band Edge Peak Emissions, Channel 2



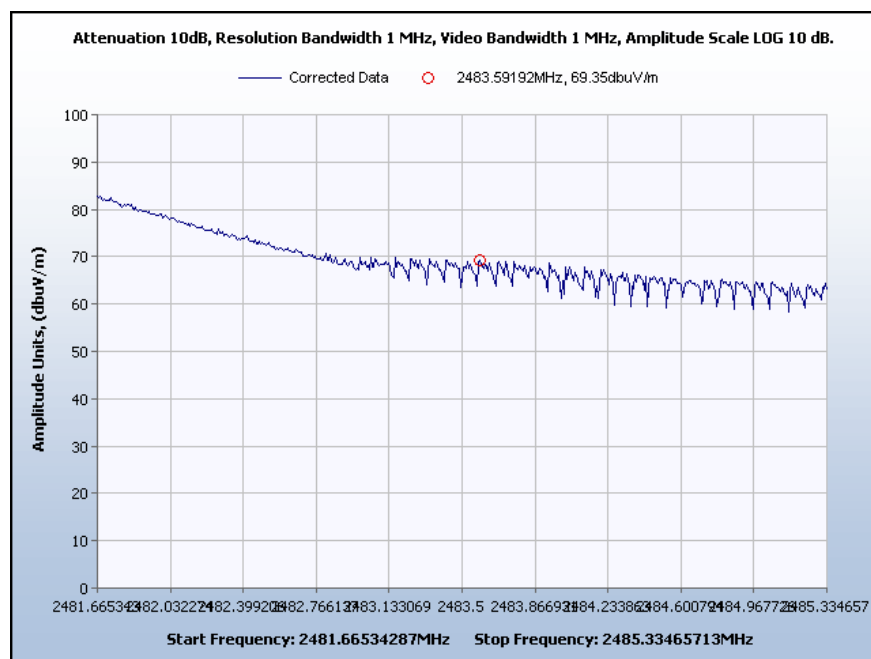
Graph 10. Band Edge Peak Emissions, Channel 13



## Band Edge Emissions – Test Results



Graph 11. Band Edge Peak Emissions, Channel 14



Graph 12. Band Edge Peak Emissions, Channel 15



## 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  $\Sigma$  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 8. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)**

**Test Procedure:** The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a 50  $\Omega$ /50  $\mu$ H Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.4-1992 "Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz"*. The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50  $\Omega$ /50  $\mu$ H LISN as the input transducer to an EMC/field intensity meter. The tests were conducted in a RF-shielded enclosure.

The EUT was operated in its normal mode of operation. Stimulating it with the RFID tag made no difference in the conducted emissions.

**Test Results:** The EUT was found compliant with the Conducted Emission limits of §15.207(a) for Intentional Radiators. See following pages for detailed test results.

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

**Test Date(s):** January 11, 2007



Outsite Networks, Inc.  
Touchpoint IAD02

Electromagnetic Compatibility  
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CFR Title 47, Part 15, Subpart C

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.207 Conducted Emissions Limits

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.1704	24.05	0.00	24.05	79	-54.95	4.81	0.00	4.81	66	-61.19
0.1951	21.22	0.00	21.22	79	-57.78	2.62	0.00	2.62	66	-63.38
0.5206	27.36	0.17	27.53	73	-45.64	22.10	0.17	22.27	60	-37.73
1.97	18.41	0.17	18.58	73	-54.59	4.66	0.17	4.83	60	-55.17
13.561	49.7	0.23	49.93	73	-23.30	49.55	0.23	49.78	60	-10.22
22.625	11.73	0.24	11.97	73	-61.27	5.19	0.24	5.43	60	-54.57

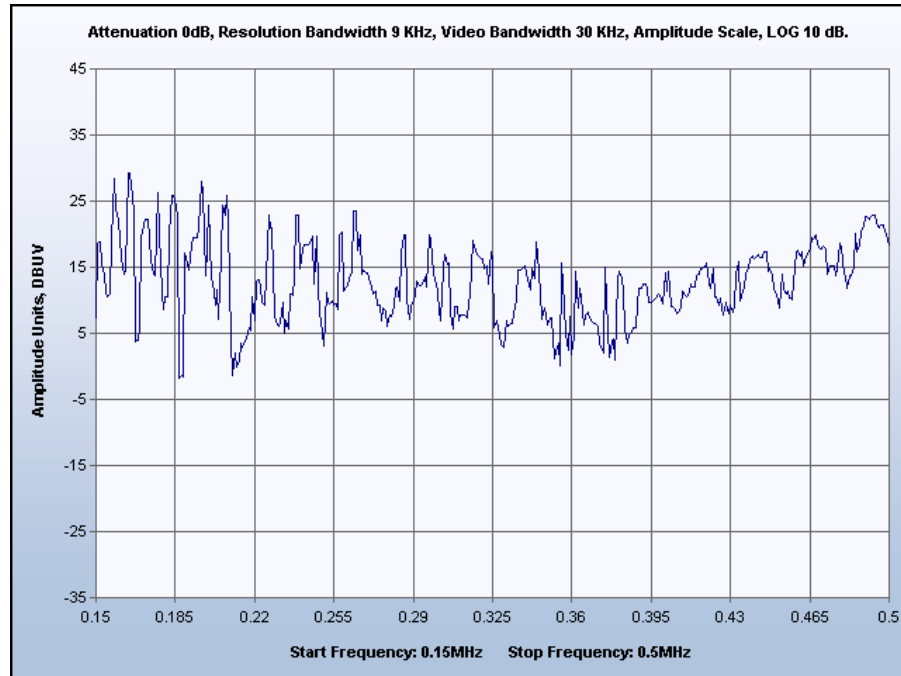
Table 9. Conducted Emissions - Voltage, Phase (120VAC, 60Hz)

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.1611	25.01	0.00	25.01	79	-53.99	6.93	0	6.93	66	-59.07
0.1973	21.56	0.00	21.56	79	-57.44	11.88	0	11.88	66	-54.12
0.5251	25.00	0.17	25.17	73	-48.00	19.83	0.17	20.00	60	-40.00
2.0275	18.69	0.17	18.86	73	-54.31	7.86	0.17	8.03	60	-51.97
13.561	49.21	0.23	49.44	73	-23.79	48.81	0.23	49.04	60	-10.96
22.325	12.56	0.25	12.81	73	-60.44	6.21	0.25	6.46	60	-53.54

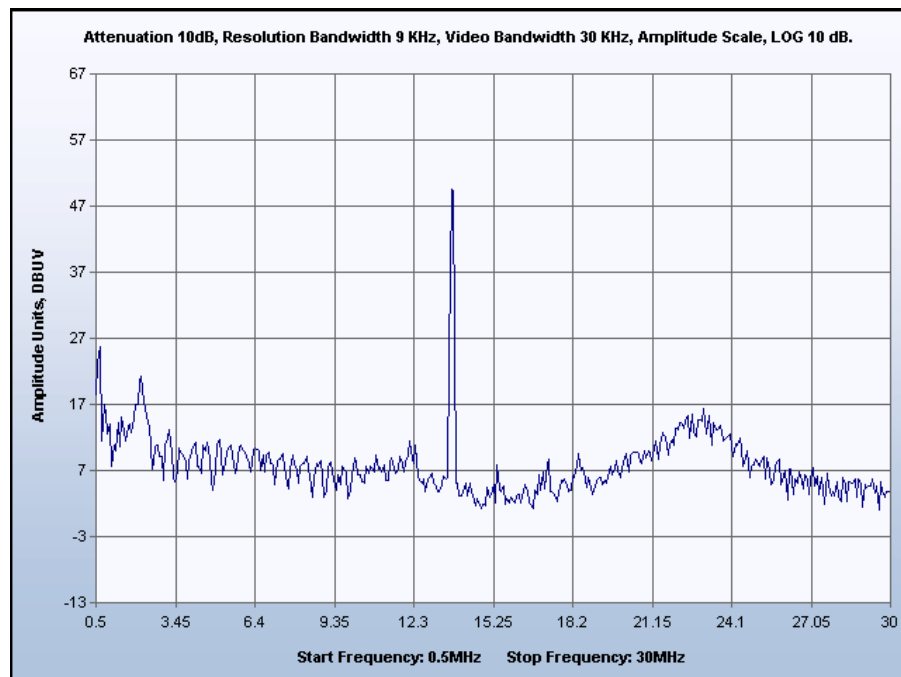
Table 10. Conducted Emissions - Voltage, Neutral (120VAC, 60Hz)



## Electromagnetic Compatibility Criteria for Intentional Radiators



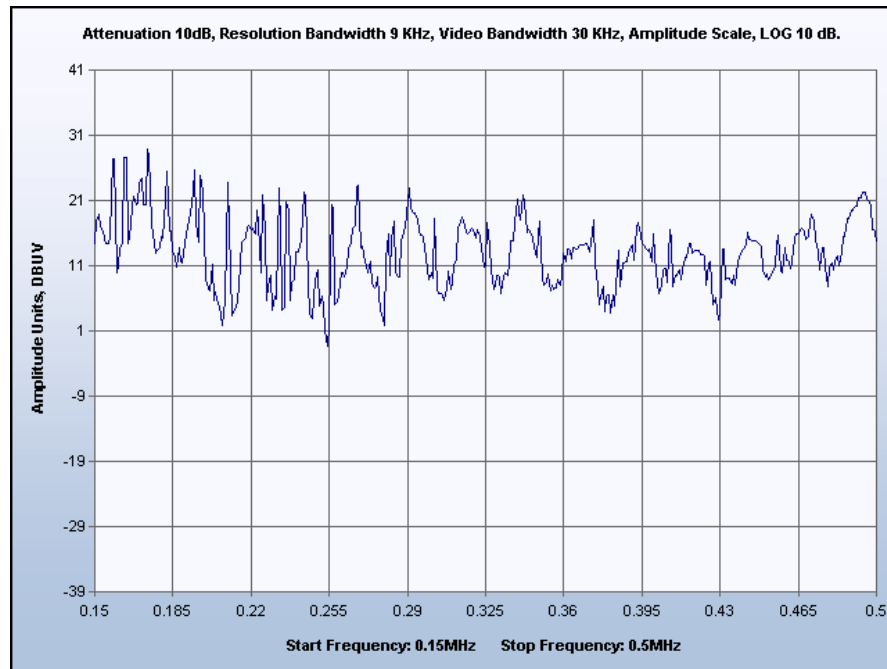
Graph 13. Conducted Emissions, Low Phase



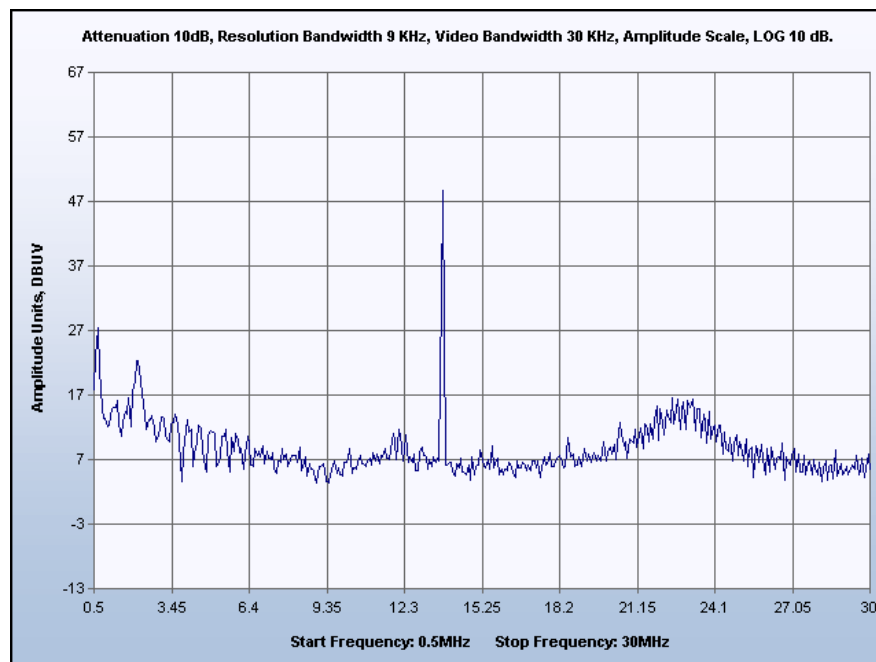
Graph 14. Conducted Emission, High Phase



## Electromagnetic Compatibility Criteria for Intentional Radiators



Graph 15. Conducted Emission, Low Neutral



Graph 16. Conducted Emission, High Neutral



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## Conducted Emission Limits Test Setup



Photograph 1. Conducted Emissions Test Setup



## Electromagnetic Compatibility Criteria for Intentional Radiators

### §15.109; § 15.209 Radiated Emissions – Unintentional Digital and Spurious

**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 11.

**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 11.

Frequency (MHz)	Field Strength (dBµV/m)	
	§15.109 (b), Class A Limit (dBµV) @ 10m	§15.109 (a), Class B Limit (dBµV) @ 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 11. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b)**

**§ 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 12:

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 12. 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 13. Radiated Emissions Limits from § 15.209 (a)**

**Test Procedure:**

For frequencies from 30 MHz to 1 GHz, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

The EUT was first setup in its normal mode of operation and placed on a 0.8 m high wooden table inside a semi-anechoic chamber. Measurements were performed with the EUT rotated 360° and varying the adjustable antenna mast with 1 m to 4 m height to determine the worst case orientation for maximum emissions. This showed the emissions most commonly associated with the unintentional digital section.

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 14 GHz, excluding the band 2.3 GHz to 2.5 GHz, which was covered under Band Edge Emissions. 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 remeasured using video averaging and plotted against an average limit line. Tabular data shows measurements of interest. Channels 0, 7, 8, and 15 were tested.

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

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

**Test Date(s):** December 29, 2006



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Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuv)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuv)	Limit (dBuv)	Margin (dB)
37.936	341	H	1.09	5.34	8.12	0.51	10.46	3.51	39.00	-35.49
37.936	143	V	1.07	11.40	7.93	0.51	10.46	9.39	39.00	-29.61
44.910	205	H	2.60	6.23	9.29	0.59	10.46	5.65	39.00	-33.35
44.910	129	V	1.00	13.44	8.39	0.59	10.46	11.96	39.00	-27.04
45.470	179	H	3.58	8.57	9.32	0.59	10.46	8.02	39.00	-30.98
45.470	93	V	1.00	15.27	8.42	0.59	10.46	13.82	39.00	-25.18
64.930	187	H	1.31	7.96	10.30	0.68	10.46	8.48	39.00	-30.52
64.930	54	V	1.00	19.72	10.40	0.68	10.46	20.34	39.00	-18.66
92.218	207	H	2.10	11.22	7.27	0.76	10.46	8.79	43.50	-34.71
92.218	34	V	1.00	19.57	6.52	0.76	10.46	16.39	43.50	-27.11
119.298	313	H	2.67	18.92	7.19	0.87	10.46	16.52	43.50	-26.98
119.298	95	V	1.00	25.33	7.34	0.87	10.46	23.08	43.50	-20.42
162.715	25	H	2.08	18.02	8.31	0.96	10.46	16.83	43.50	-26.67
162.715	22	V	1.00	22.50	8.26	0.96	10.46	21.26	43.50	-22.24
176.283	28	H	1.65	22.19	9.15	1.09	10.46	21.97	43.50	-21.53
176.283	103	V	1.00	22.88	9.10	1.09	10.46	22.61	43.50	-20.89
203.401	226	H	2.10	14.35	10.37	1.21	10.46	15.46	43.50	-28.04
203.401	143	V	1.00	19.76	10.27	1.21	10.46	20.78	43.50	-22.72
257.636	5	H	1.10	20.85	12.85	1.38	10.46	24.62	46.40	-21.78
257.636	231	V	1.00	21.82	12.48	1.38	10.46	25.23	46.40	-21.17
284.760	-1	H	1.08	22.50	12.69	1.43	10.46	26.15	46.40	-20.25
284.760	308	V	1.00	19.26	12.19	1.43	10.46	22.41	46.40	-23.99

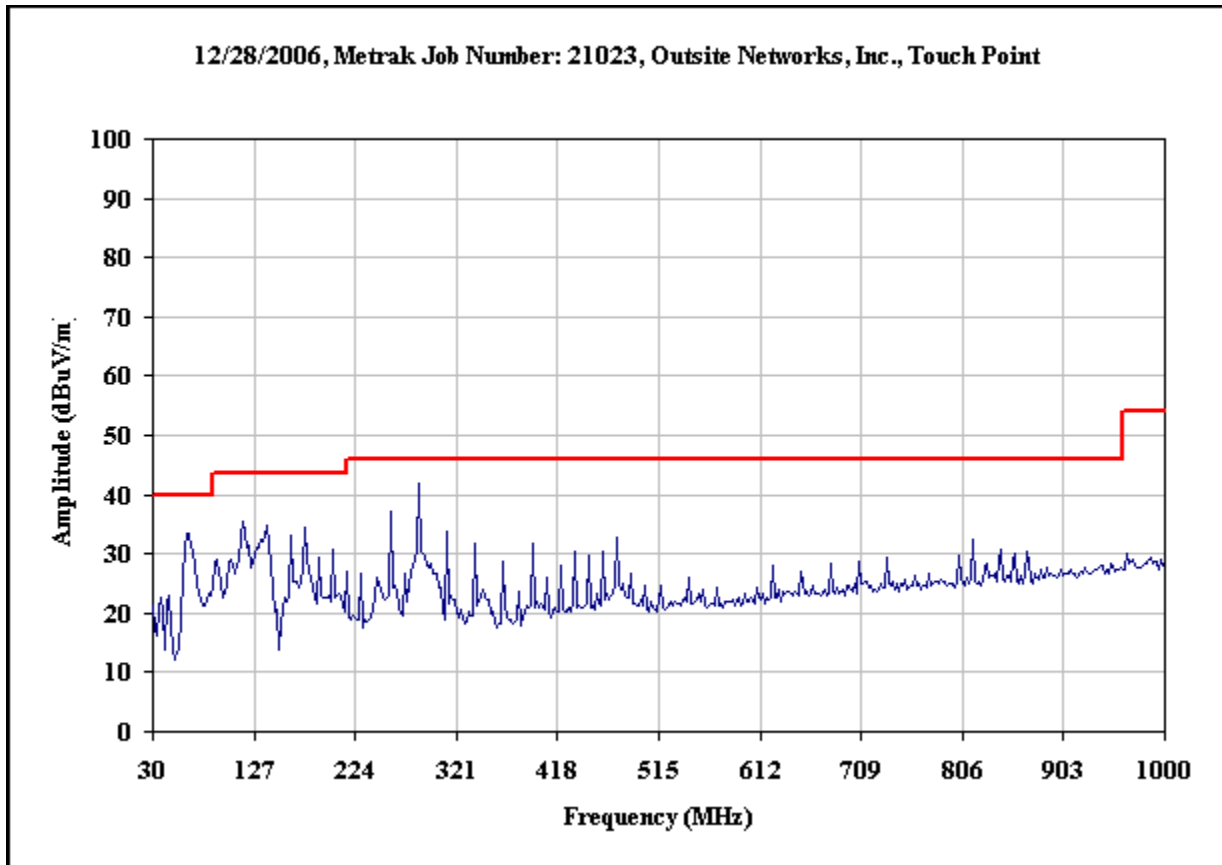
**Table 14. Radiated Emissions (30 MHz to 1 GHz)**

Note 1: The EUT was tested at 3 m. The data has been corrected for comparison with the 10 m limit using the formula:  $20\log(3\text{ m}/10\text{ m})$  as expressed in the 'Distance Correction' column.



## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.109 Radiated Emissions – Unintentional Digital



Graph 17. Radiated Emissions (30 MHz to 1 GHz), Pre-Scan



## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.209 Radiated Emissions – Spurious

Channel	Frequency (GHz)	Average Measurement (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
0	4.811	39.41	54	-14.59
7	4.88	53.12	54	-0.88
8	4.89	48.51	54	-5.49
7	7.319	46.1	54	-7.9
8	7.336	46.89	54	-7.11
7	9.762	42.95	54	-11.05
8	9.782	42.36	54	-11.64
7	12.202	41.84	54	-12.16
8	12.227	41.36	54	-12.64
7	14.643	45.25	54	-8.75
8	14.667	43.71	54	-10.29

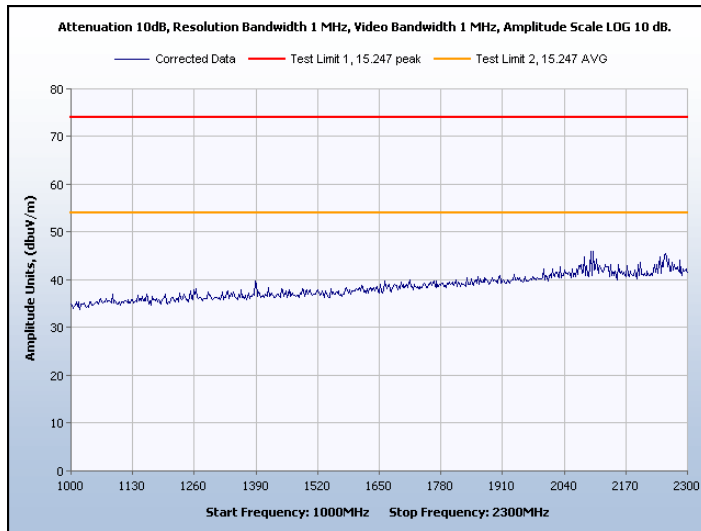
Table 15. Spurious Radiated Emissions, Average Test Results

Channel	Frequency (GHz)	Peak Measurement (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)
0	4.81	48.15	74	-25.85
7	4.88	64.32	74	-9.68
8	4.89	65.51	74	-8.49
7	7.318	53.54	74	-20.46
8	7.336	56.89	74	-17.11
7	9.76	53.8	74	-20.2
8	9.78	53.83	74	-20.17
7	12.205	51.34	74	-22.66
8	12.23	51.71	74	-22.29
0	4.81	48.15	74	-25.85
7	4.88	64.32	74	-9.68

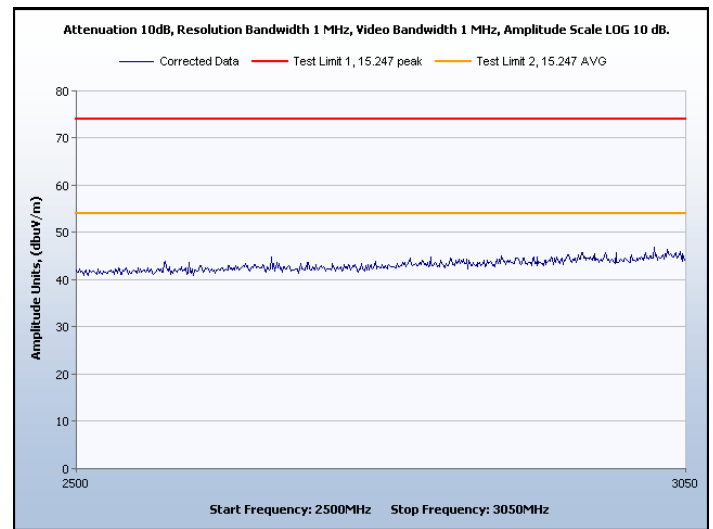
Table 16. Spurious Radiated Emissions, Peak Test Results



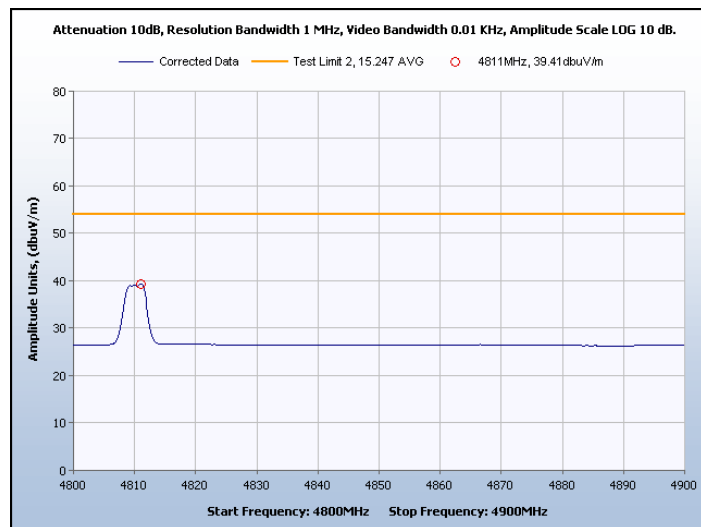
## § 15.209 Spurious Emissions Requirements – Radiated



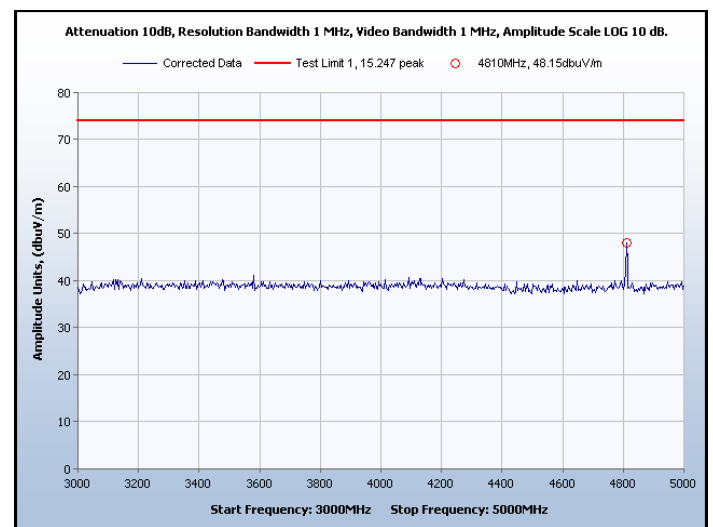
Graph 18. Spurious Radiated Emissions, Channel 0, Peak and Average



Graph 19. Spurious Radiated Emissions, Channel 0, Peak and Average



Graph 20. Spurious Radiated Emissions, Channel 0, Average



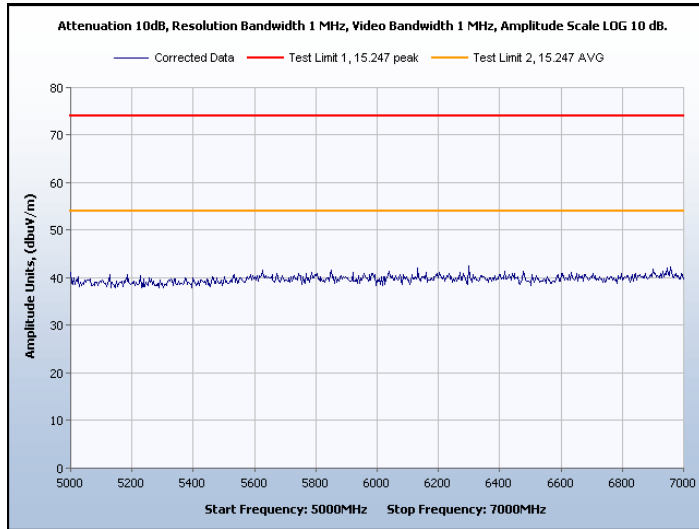
Graph 21. Spurious Radiated Emissions, Channel 0, Peak



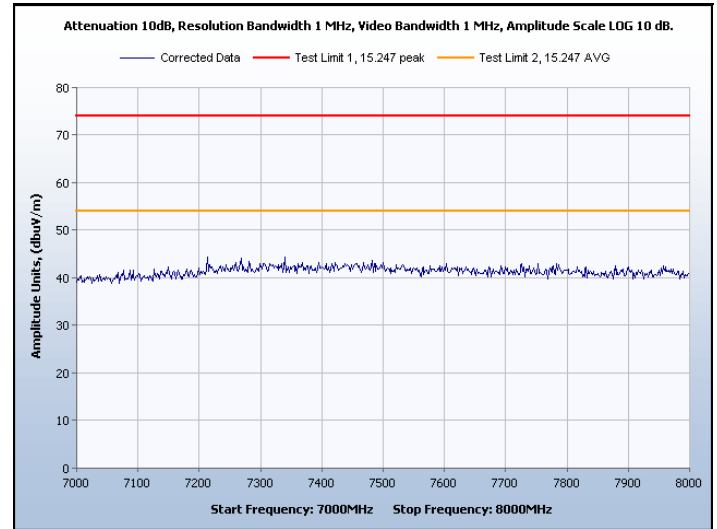
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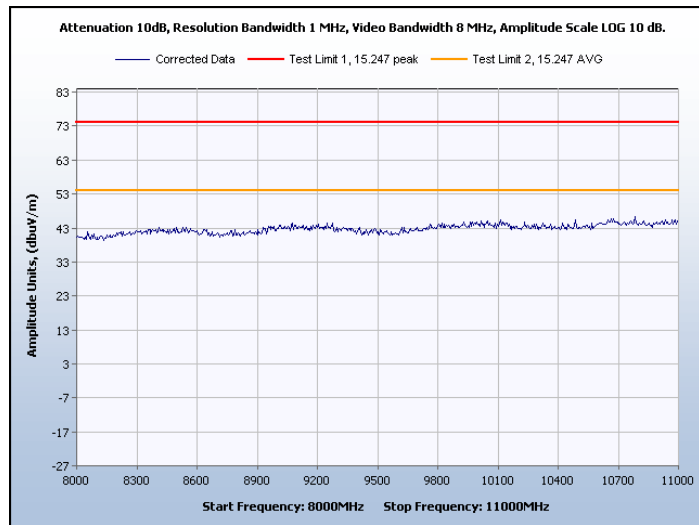
## § 15.209 Spurious Emissions Requirements – Radiated



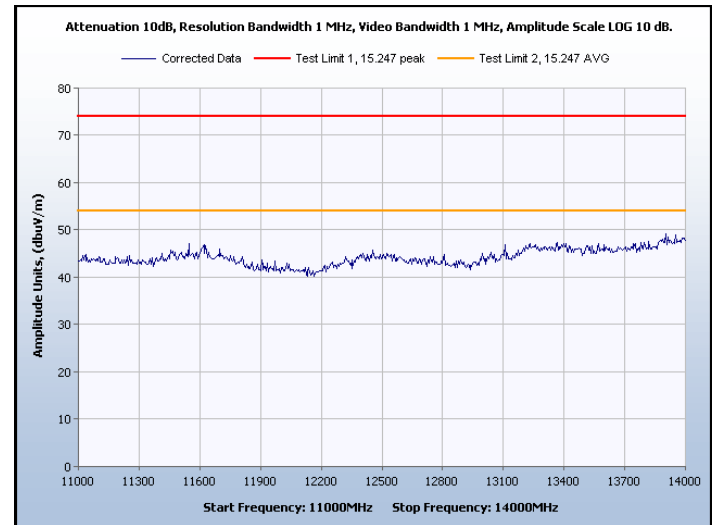
Graph 22. Spurious Radiated Emissions, Channel 0, Peak and Average



Graph 23. Spurious Radiated Emissions, Channel 0, Peak and Average



Graph 24. Spurious Radiated Emissions, Channel 0, Peak and Average



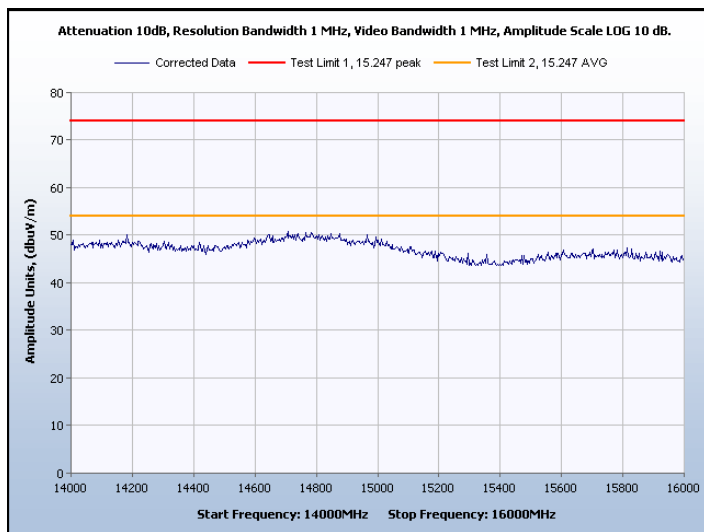
Graph 25. Spurious Radiated Emissions, Channel 0, Peak and Average



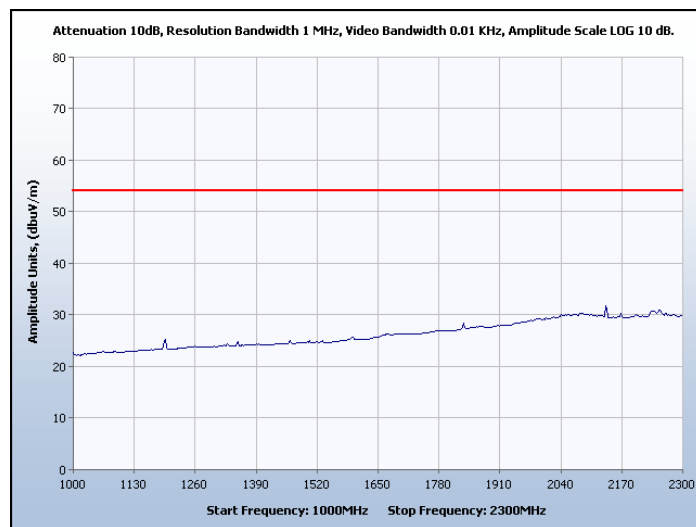
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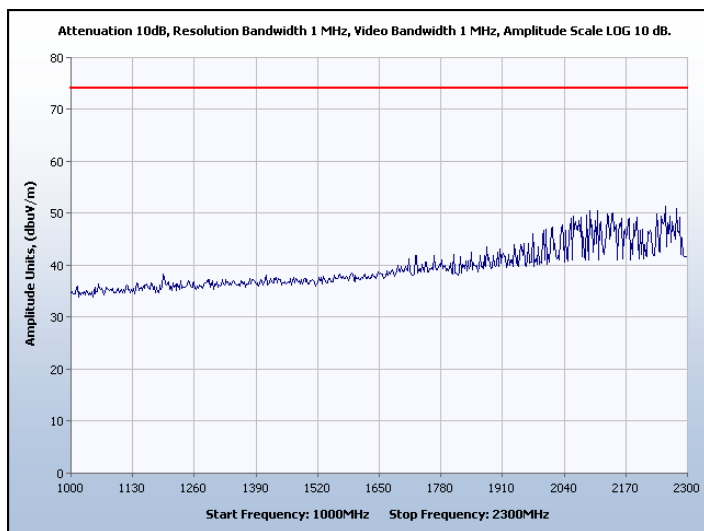
## § 15.209 Spurious Emissions Requirements – Radiated



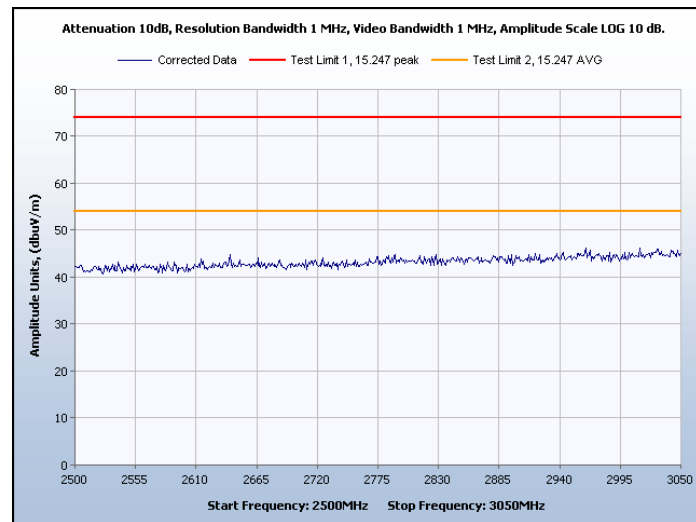
Graph 26. Spurious Radiated Emissions, Channel 0, Peak and Average



Graph 27. Spurious Radiated Emissions, Channel 7, Average



Graph 28. Spurious Radiated Emissions, Channel 7, Peak

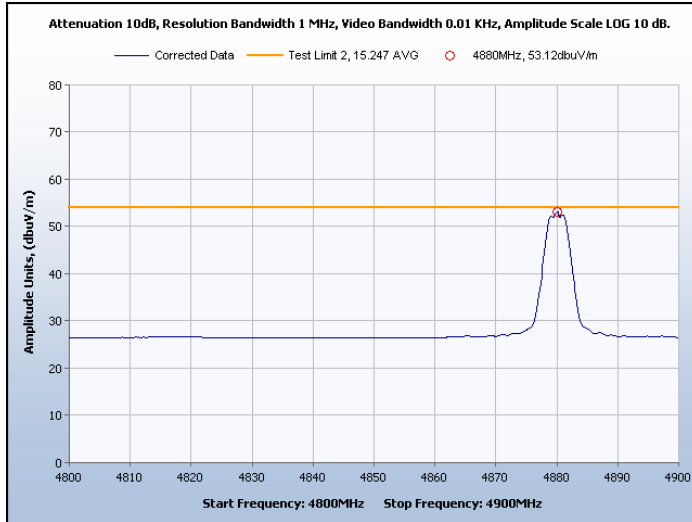


Graph 29. Spurious Radiated Emissions, Channel 7, Peak and Average

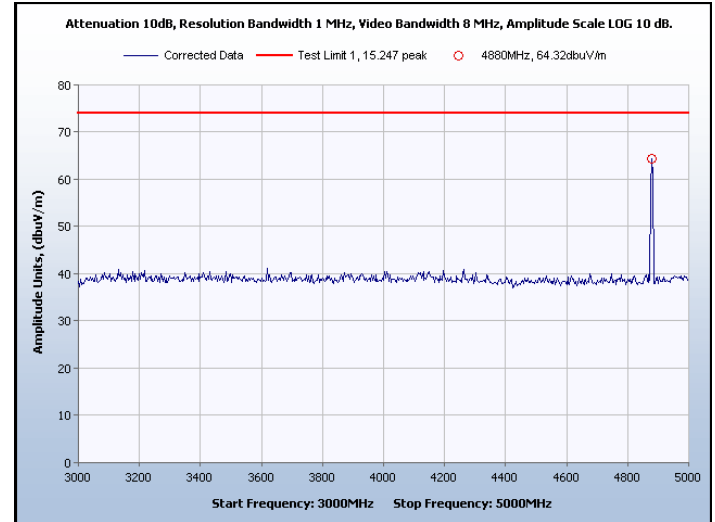




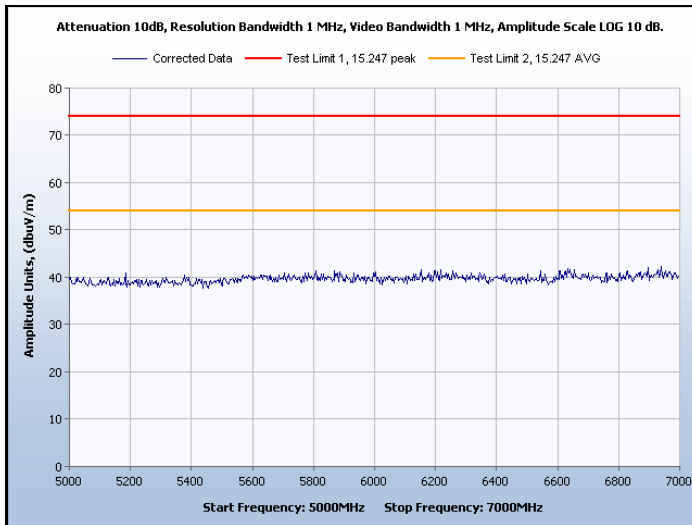
## § 15.209 Spurious Emissions Requirements – Radiated



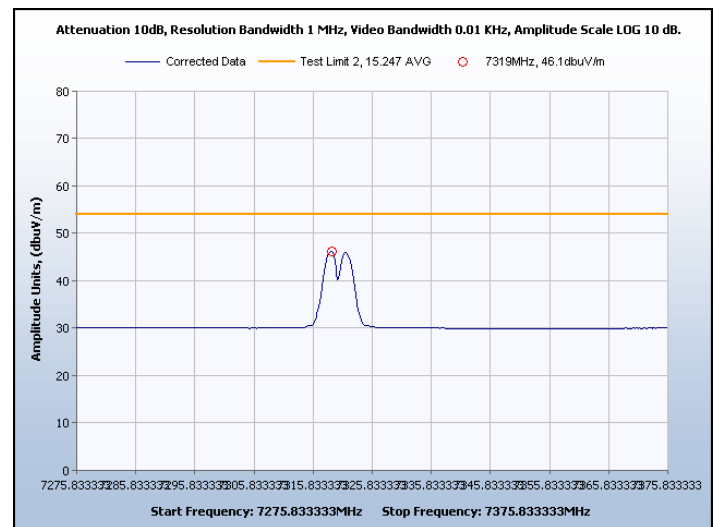
Graph 30. Spurious Radiated Emissions, Channel 7, Average



Graph 31. Spurious Radiated Emissions, Channel 7, Peak



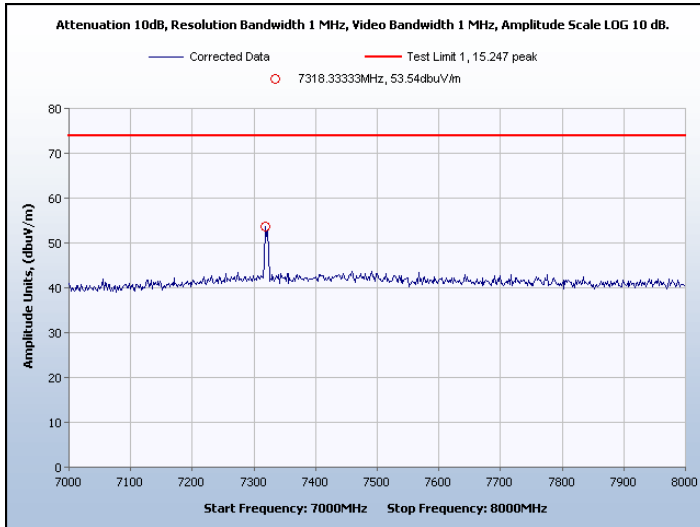
Graph 32. Spurious Radiated Emissions, Channel 7, Peak and Average



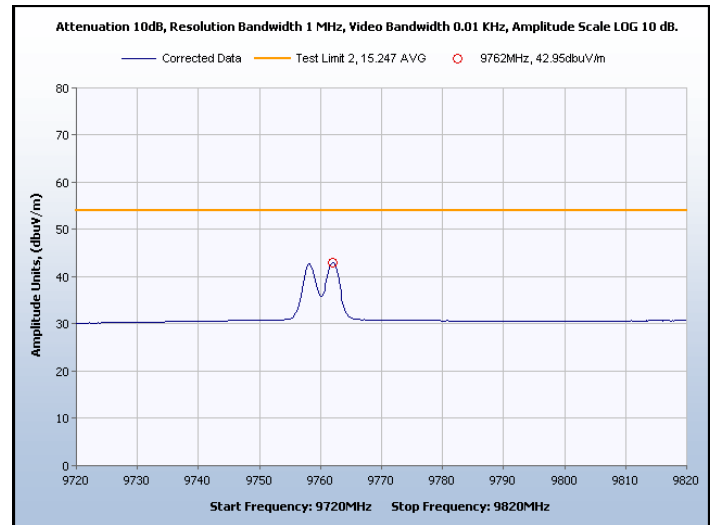
Graph 33. Spurious Radiated Emissions, Channel 7, Average



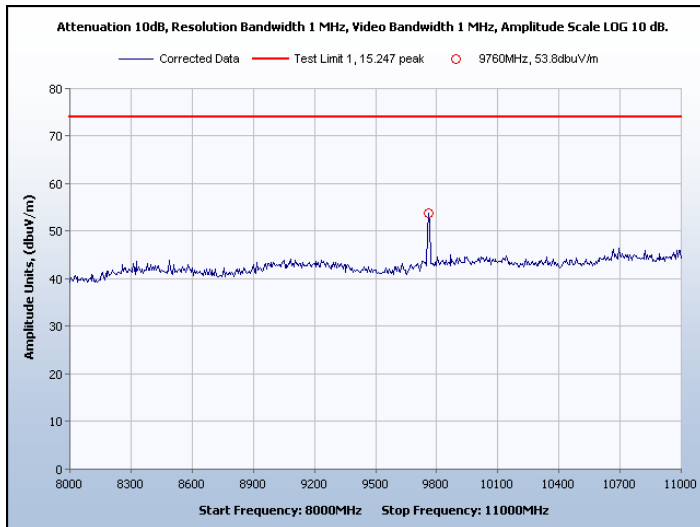
## § 15.209 Spurious Emissions Requirements – Radiated



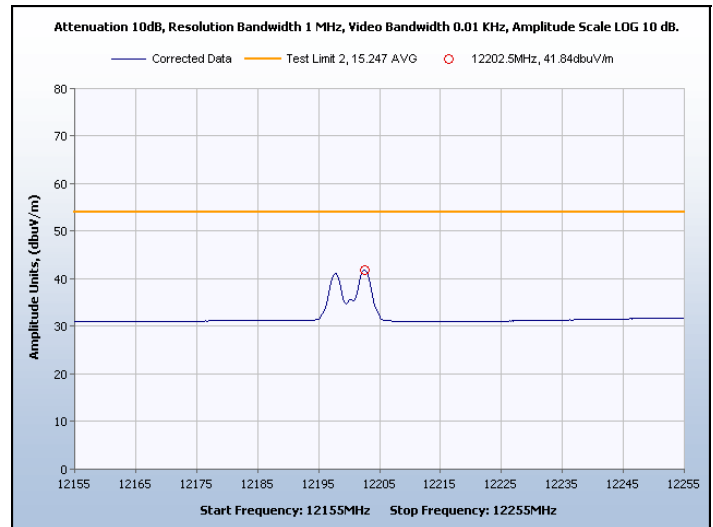
Graph 34. Spurious Radiated Emissions, Channel 7, Peak



Graph 35. Spurious Radiated Emissions, Channel 7, Average



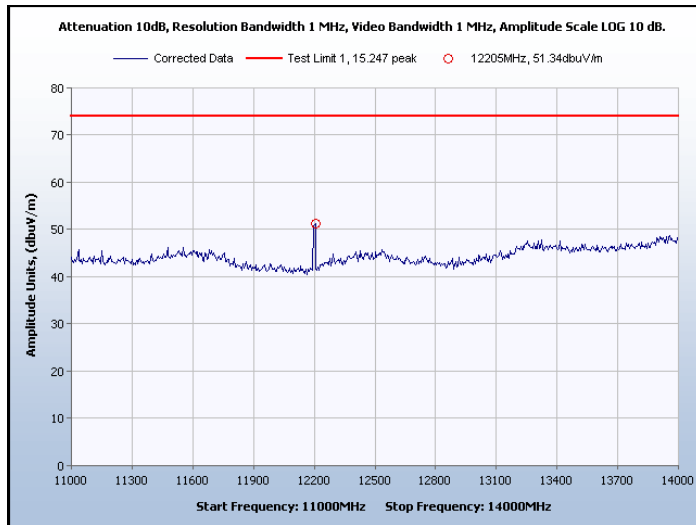
Graph 36. Spurious Radiated Emissions, Channel 7, Peak



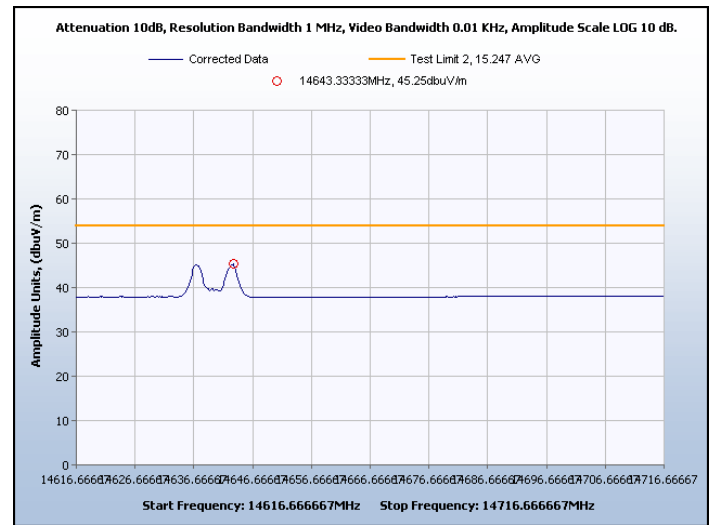
Graph 37. Spurious Radiated Emissions, Channel 7, Average



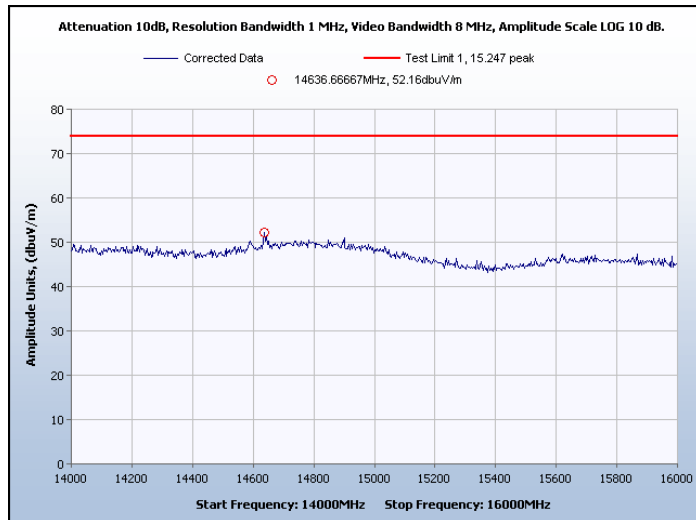
## § 15.209 Spurious Emissions Requirements – Radiated



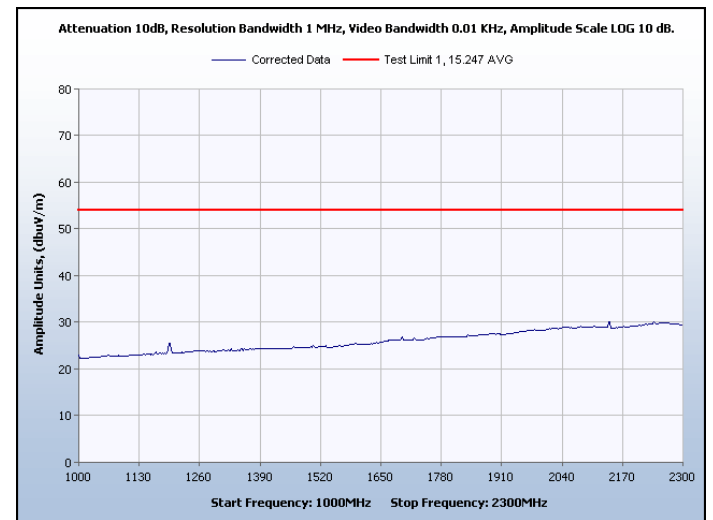
Graph 38. Spurious Radiated Emissions, Channel 7, Peak



Graph 39. Spurious Radiated Emissions, Channel 7, Average



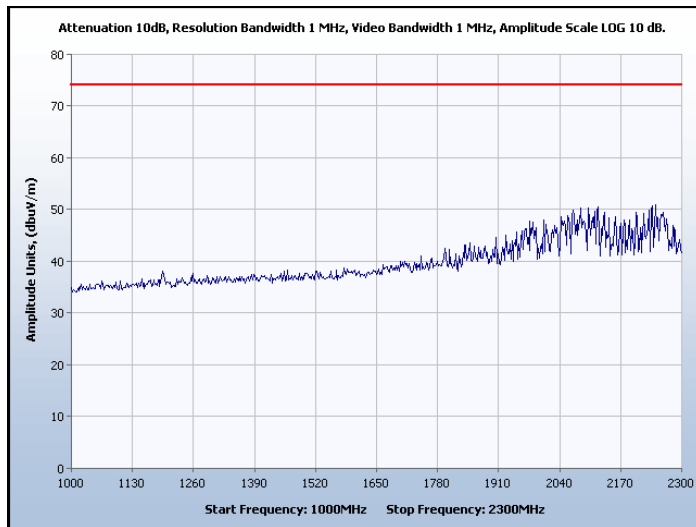
Graph 40. Spurious Radiated Emissions, Channel 7, Peak



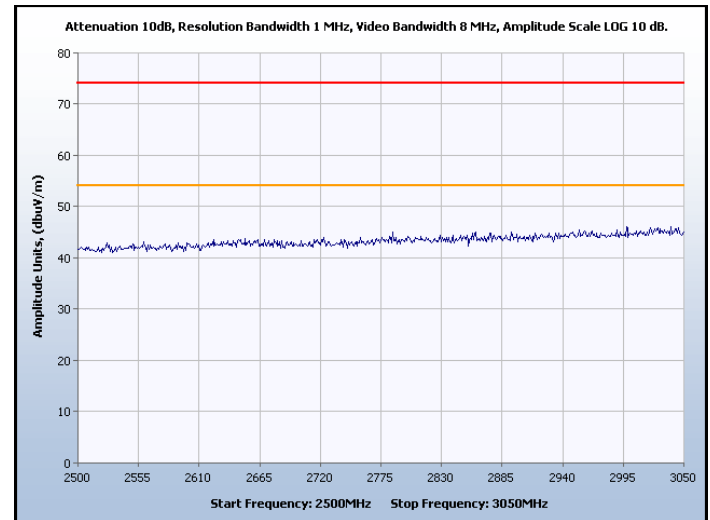
Graph 41. Spurious Radiated Emissions, Channel 8, Average



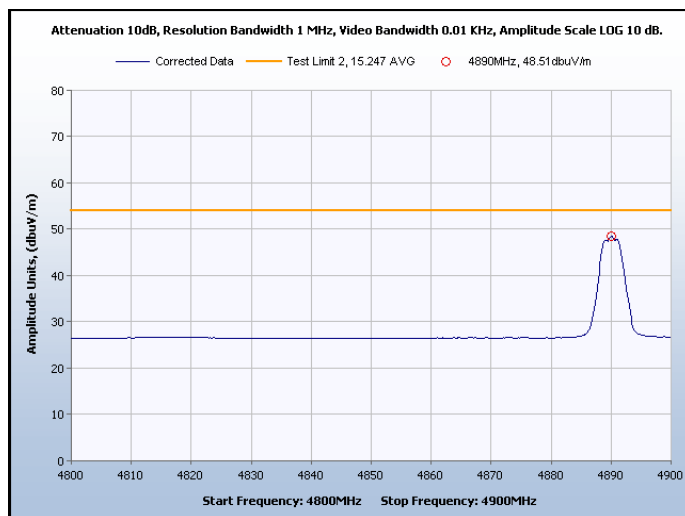
## § 15.209 Spurious Emissions Requirements – Radiated



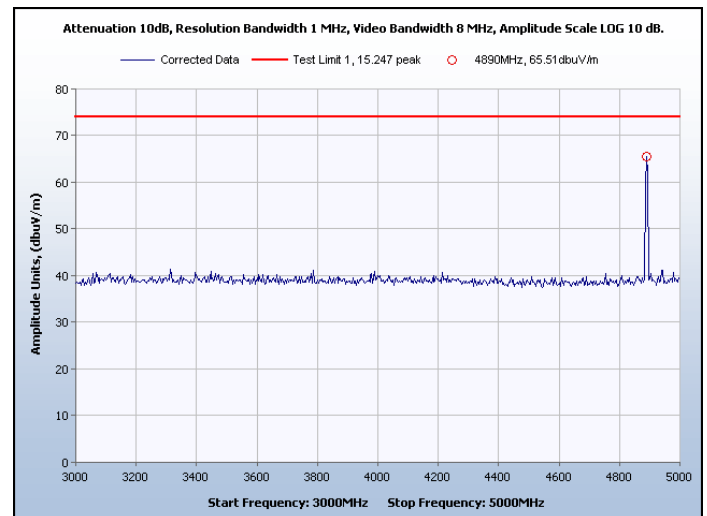
Graph 42. Spurious Radiated Emissions, Channel 8, Peak



Graph 43. Spurious Radiated Emissions, Channel 8, Peak and Average



Graph 44. Spurious Radiated Emissions, Channel 8, Average



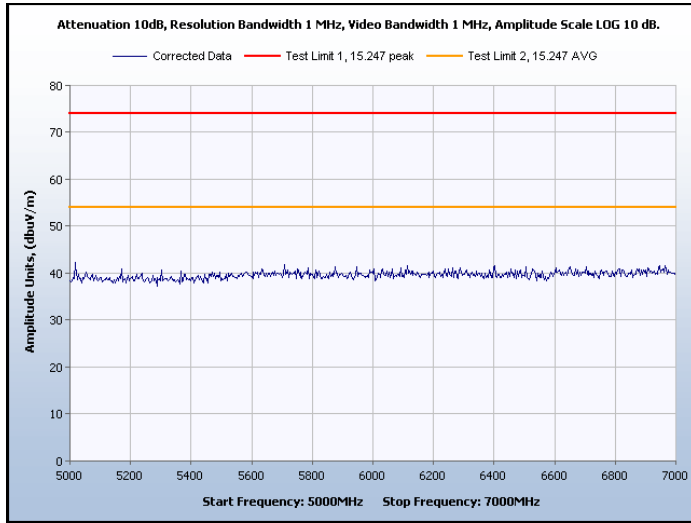
Graph 45. Spurious Radiated Emissions, Channel 8, Peak



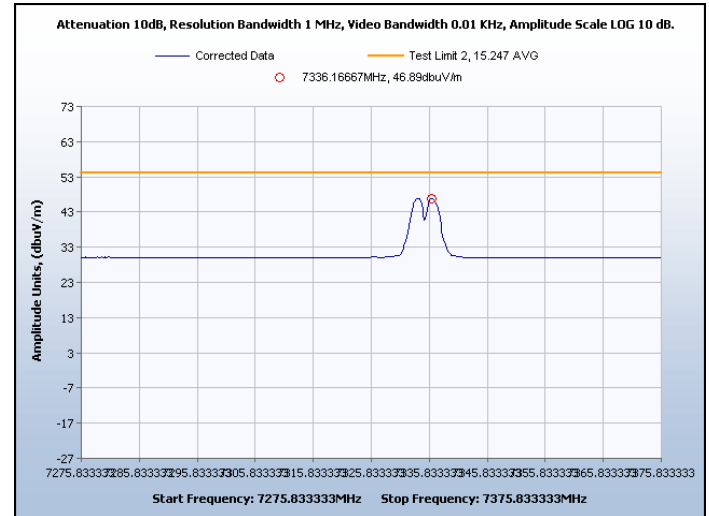
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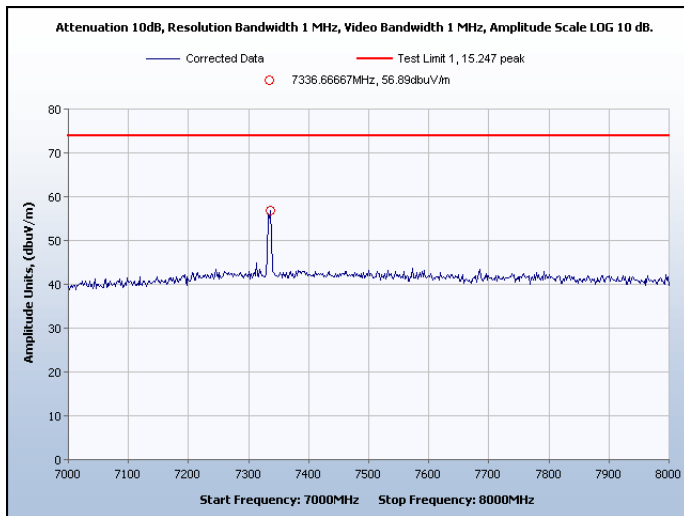
## § 15.209 Spurious Emissions Requirements – Radiated



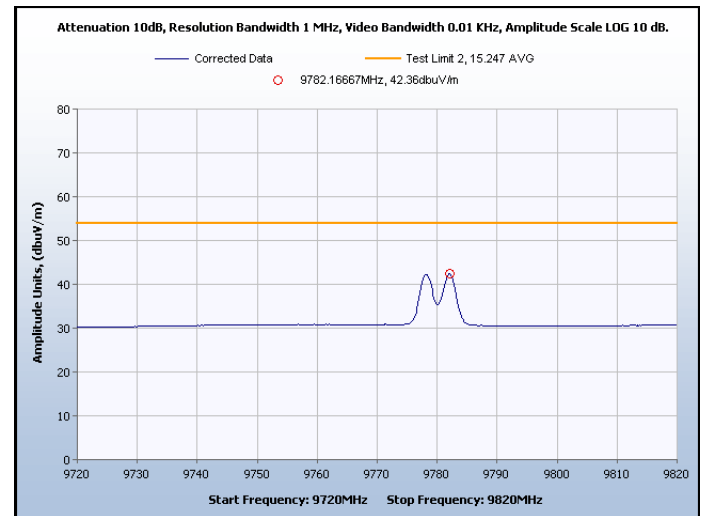
Graph 46. Spurious Radiated Emissions, Channel 8, Peak and Average



Graph 47. Spurious Radiated Emissions, Channel 8, Average



Graph 48. Spurious Radiated Emissions, Channel 8, Peak



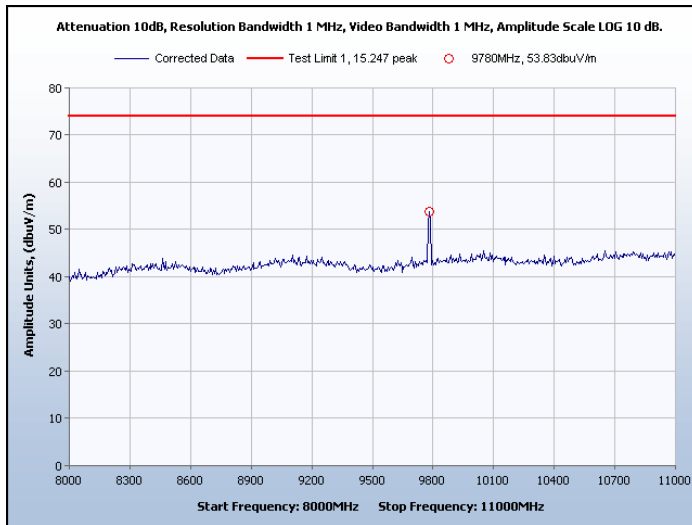
Graph 49. Spurious Radiated Emissions, Channel 8, Average



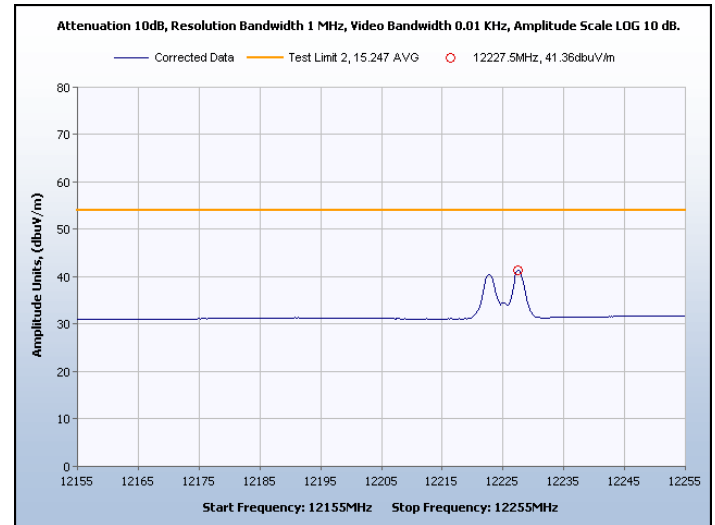
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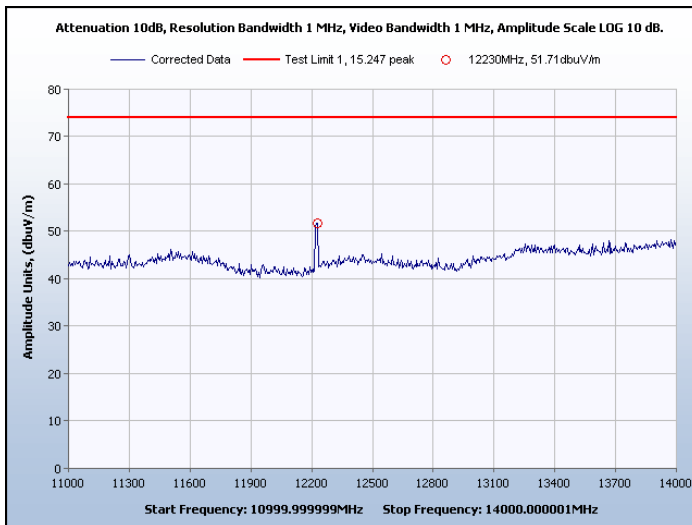
## § 15.209 Spurious Emissions Requirements – Radiated



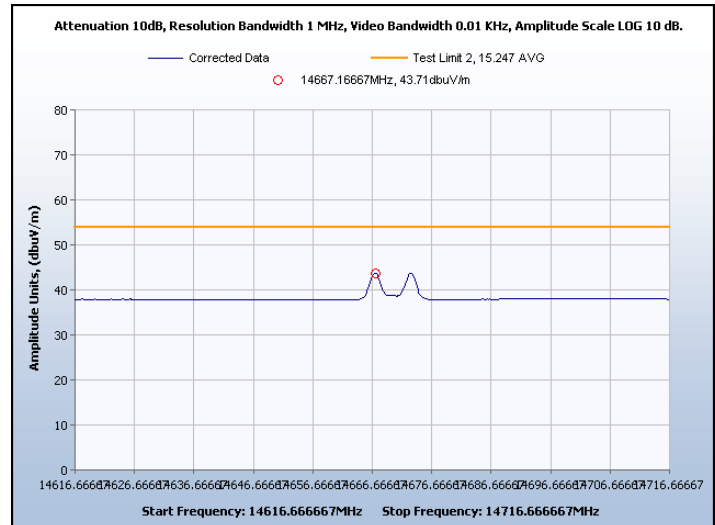
Graph 50. Spurious Radiated Emissions, Channel 8, Peak



Graph 51. Spurious Radiated Emissions, Channel 8, Average



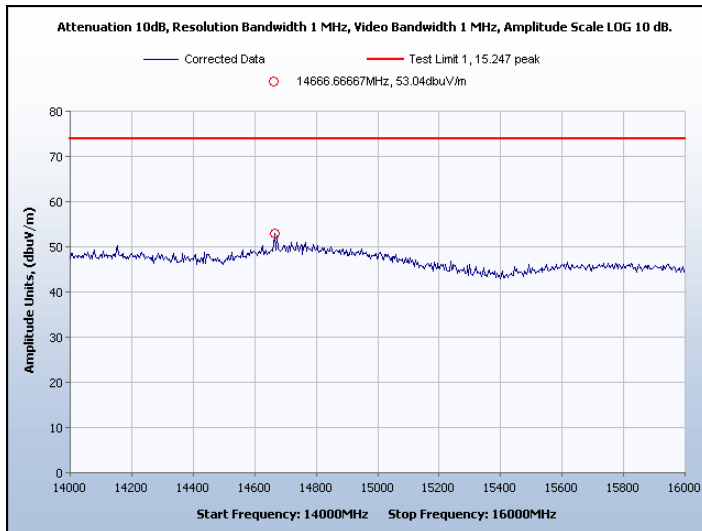
Graph 52. Spurious Radiated Emissions, Channel 8, Peak



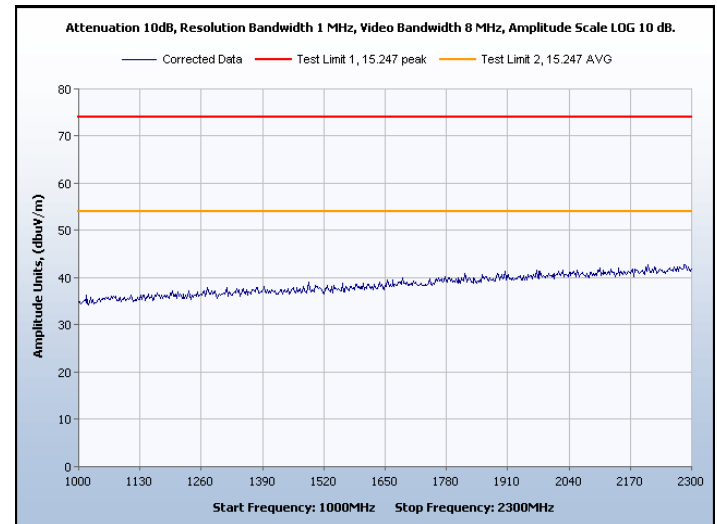
Graph 53. Spurious Radiated Emissions, Channel 8, Average



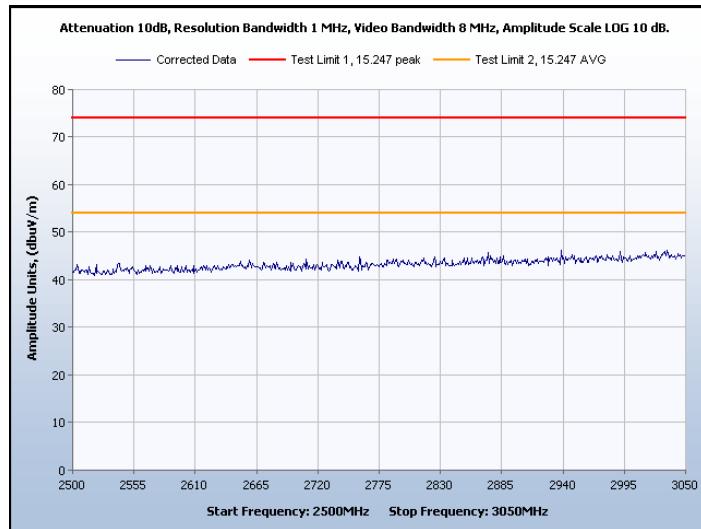
## § 15.209 Spurious Emissions Requirements – Radiated



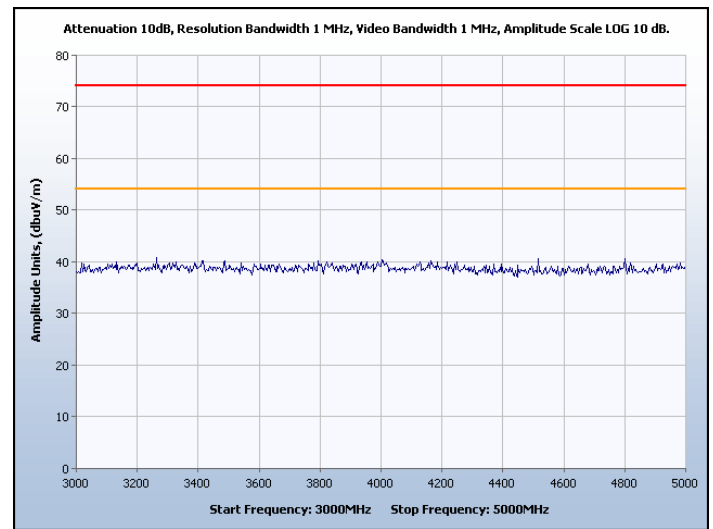
Graph 54. Spurious Radiated Emissions, Channel 8, Peak



Graph 55. Spurious Radiated Emissions, Channel 15, Peak and Average



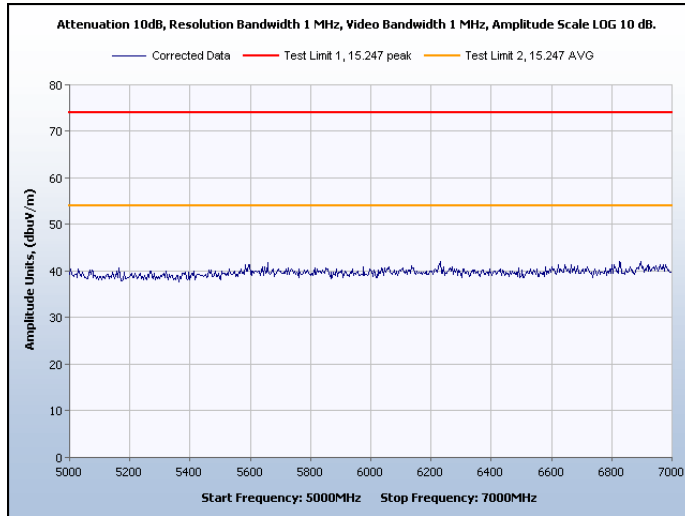
Graph 56. Spurious Radiated Emissions, Channel 15, Peak and Average



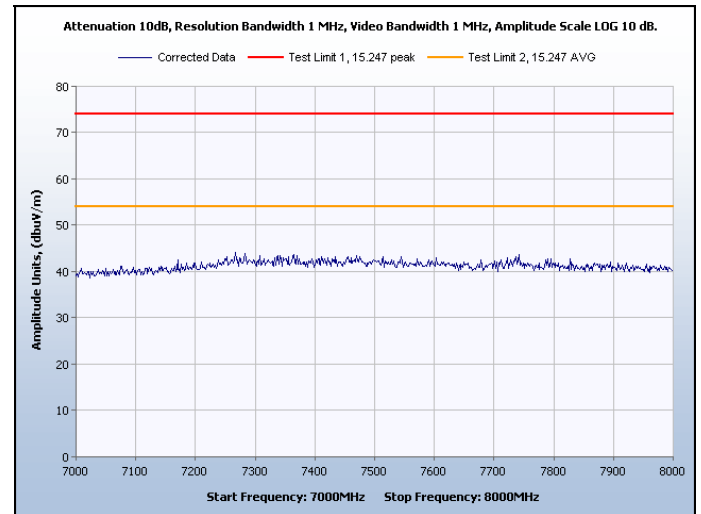
Graph 57. Spurious Radiated Emissions, Channel 15, Peak and Average



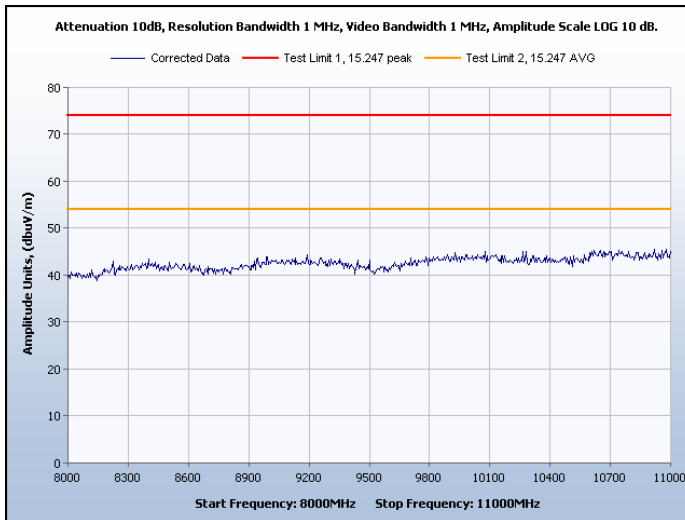
## § 15.209 Spurious Emissions Requirements – Radiated



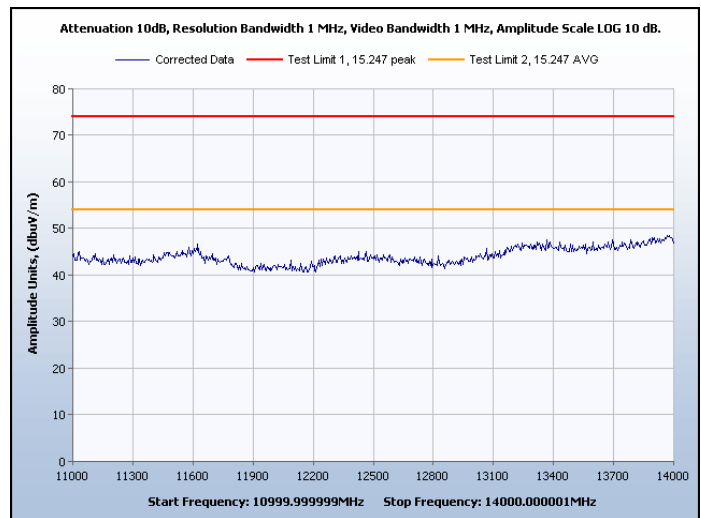
Graph 58. Spurious Radiated Emissions, Channel 15, Peak and Average



Graph 59. Spurious Radiated Emissions, Channel 15, Peak and Average



Graph 60. Spurious Radiated Emissions, Channel 15, Peak and Average

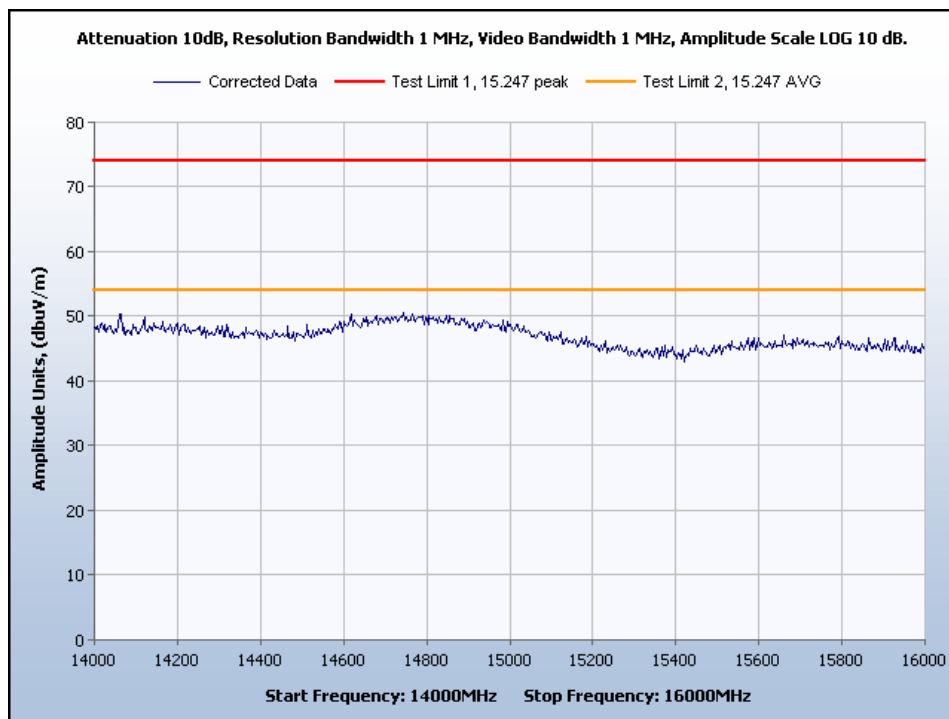


Graph 61. Spurious Radiated Emissions, Channel 15, Peak and Average





## § 15.209 Spurious Emissions Requirements – Radiated



Graph 62. Spurious Radiated Emissions, Channel 15, Peak and Average



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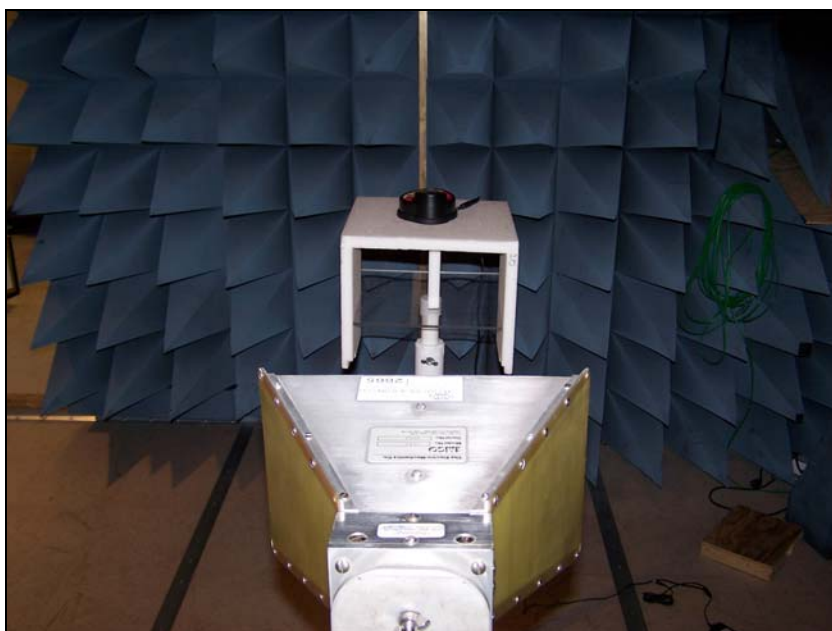
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## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.109; § 15.209 Radiated Emissions Limits



Photograph 2. Radiated Emission Test Setup (30 MHz to 1 GHz)



Photograph 3. Spurious Radiated Emissions, Test Setup



## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(a) 6 dB a Bandwidth

<b>Test Requirements:</b>	<p>§ 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:</p> <p>§ 15.247(a)(2): 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.</p>
<b>Test Procedure:</b>	<p>A sample of the EUT filled with an SMA connector in place of the F antenna was used.</p> <p>The transmitter was set to the channels 0, 7, 8, and 15 at the highest output power and connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW of 100 kHz, VBW &gt; RBW. The 6 dB Bandwidth was measured and recorded.</p>
<b>Test Results:</b>	<p>Equipment complies with § 15.247 (a). The 6 dB Bandwidth was determined from the plots on the following pages.</p>
<b>Test Engineer:</b>	<p>Len Knight</p>
<b>Test Date:</b>	<p>January 4, 2007</p>

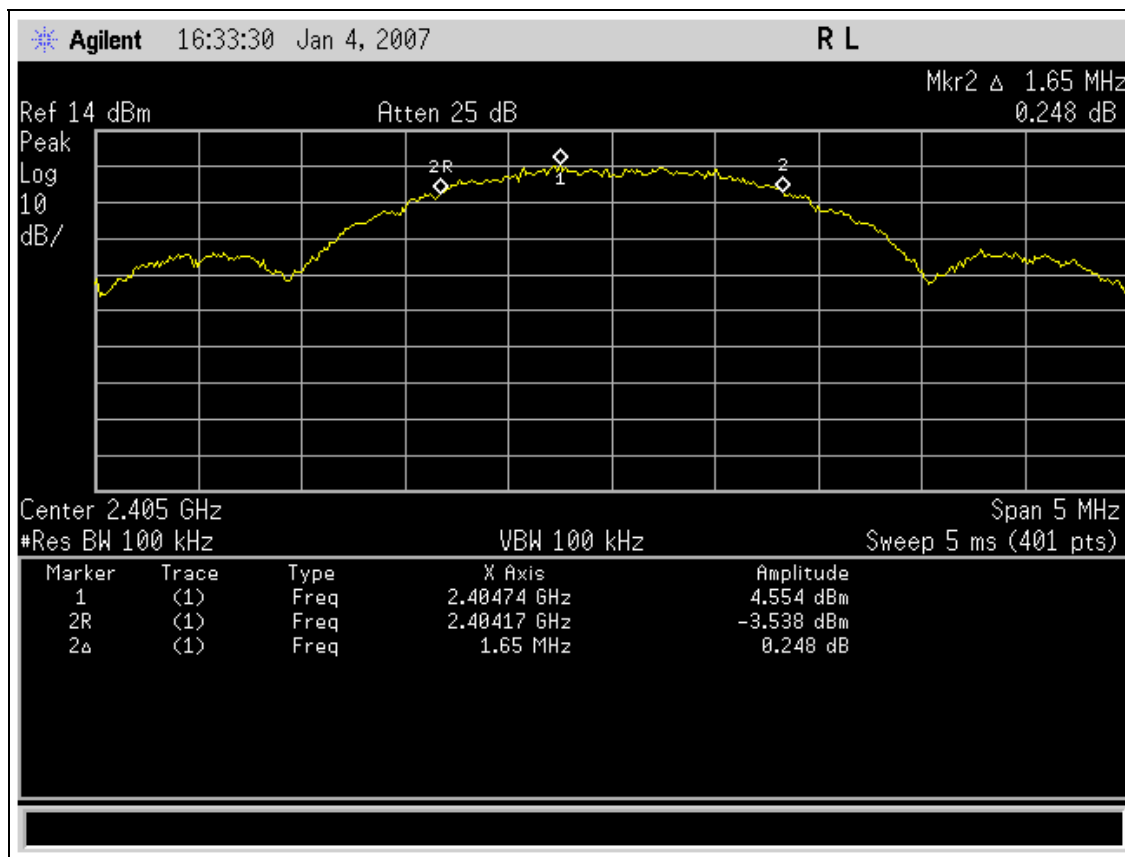


## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(a) 6 dB Bandwidth

Channel	Measured 6 dB Bandwidth	Test Limit (kHz)
0	1.65 MHz	$\geq 500$
7	1.43 MHz	$\geq 500$
8	1.49 MHz	$\geq 500$
15	1.61 MHz	$\geq 500$

Table 17. 6 dB Bandwidth Test Results

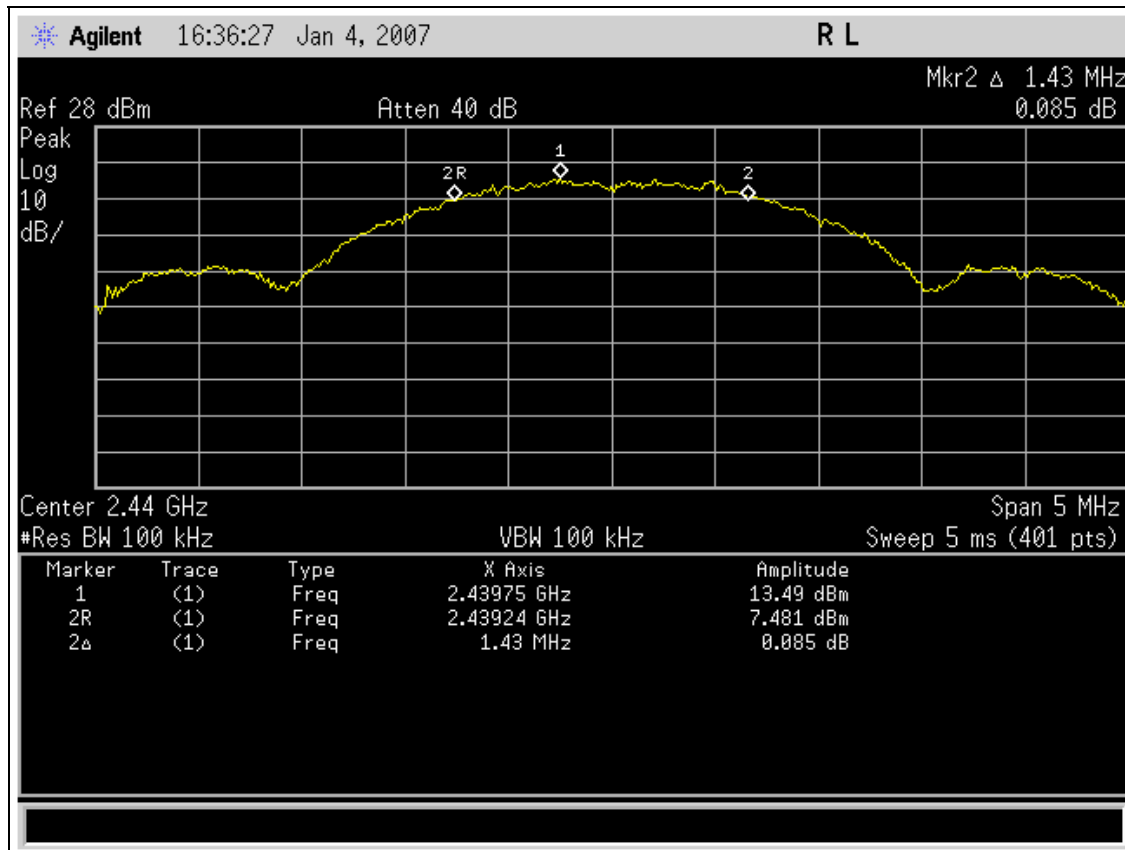


Graph 63. 6 dB Bandwidth, Channel 0



## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(a) 6 dB Bandwidth

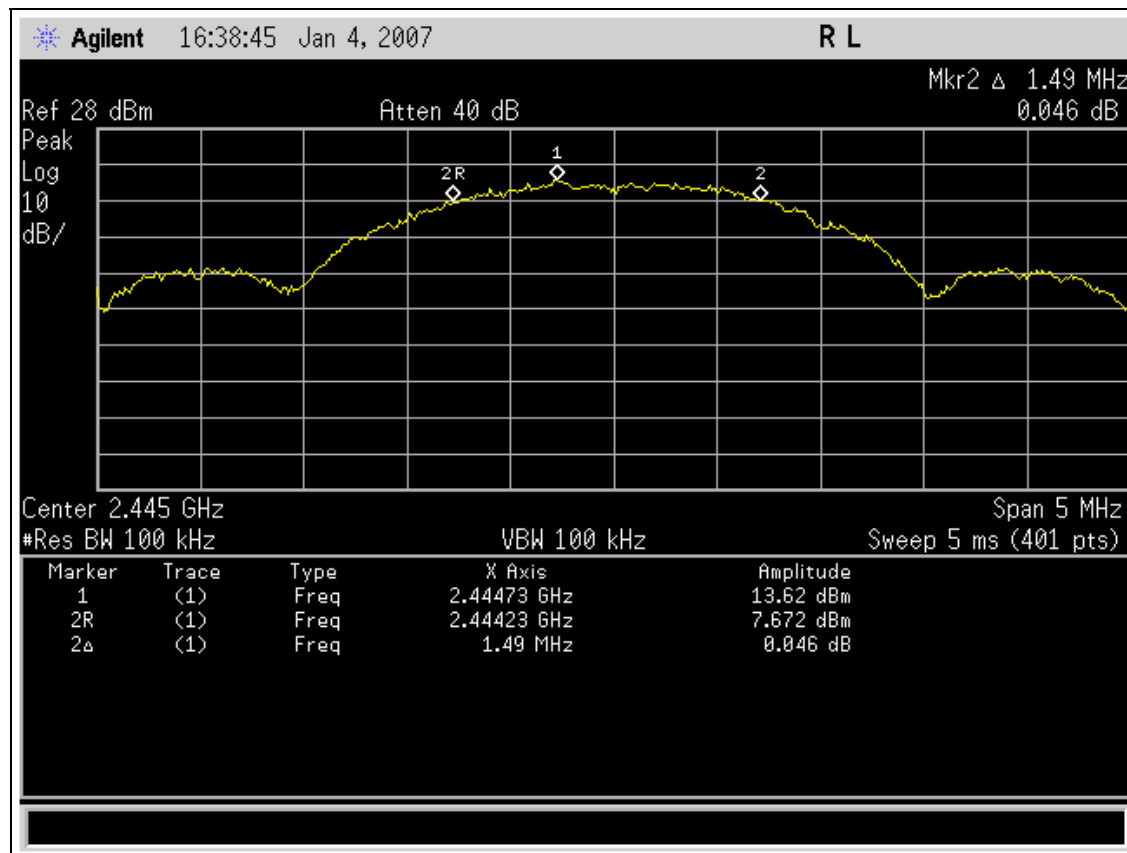


Graph 64. 6 dB Bandwidth, Channel 7



## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(a) 6 dB Bandwidth

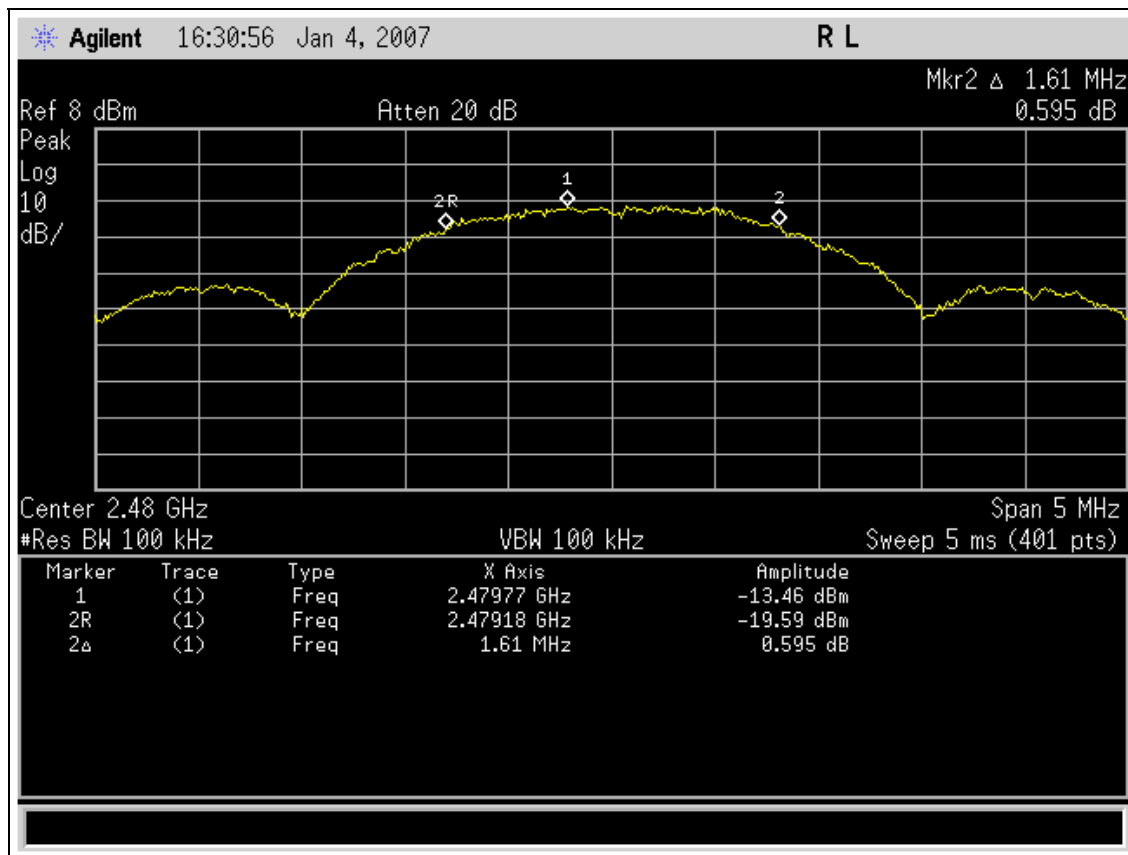


Graph 65. 6 dB Bandwidth, Channel 8



## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(a) 6 dB Bandwidth



Graph 66. 6 dB Bandwidth, Channel 15



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## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(a) 6 dB Bandwidth



Photograph 4. 6 dB Bandwidth Test Setup





## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(b) Peak Power Output

**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 18. 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 18, 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.



## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(b) Peak Power Output

**Test Procedure:** A sample of the EUT fitted with an SMA connector, in place of the F antenna was used.

The transmitter was connected to a calibrated PSA Spectrum Analyzer. The EUT was measured at each channel.

**Test Results:** Equipment complies with the Peak Power Output limits of § 15.247(b).

Channel #	Measured Output Power (dBm)
0	8.91
1	18.28
2	18.94
3	18.69
4	18.46
5	18.92
6	19.09
7	18.67
8	18.94
9	19.02
10	18.69
11	19.61
12	16.81
13	9.02
14	5.7
15	-7.74

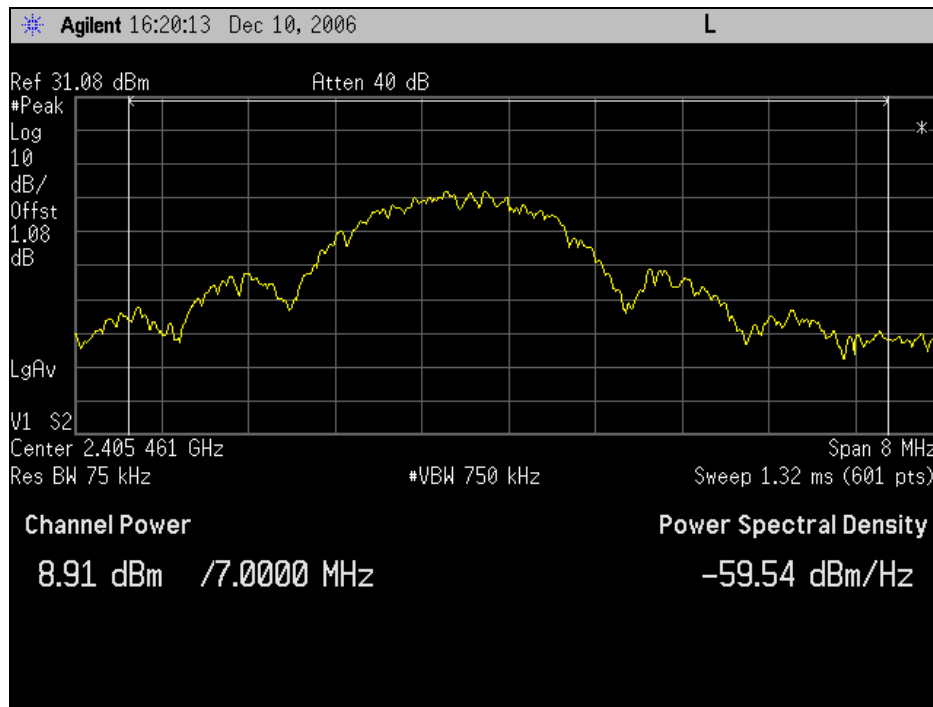
**Table 19. Peak Output Power**

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

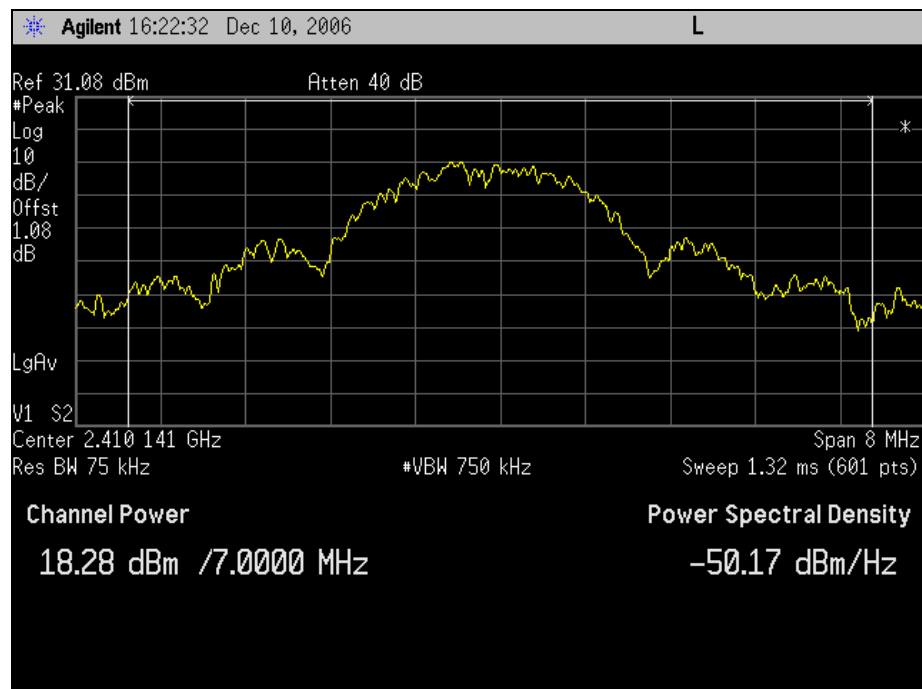
**Test Date(s):** January 9, 2007



## Electromagnetic Compatibility Criteria for Intentional Radiators



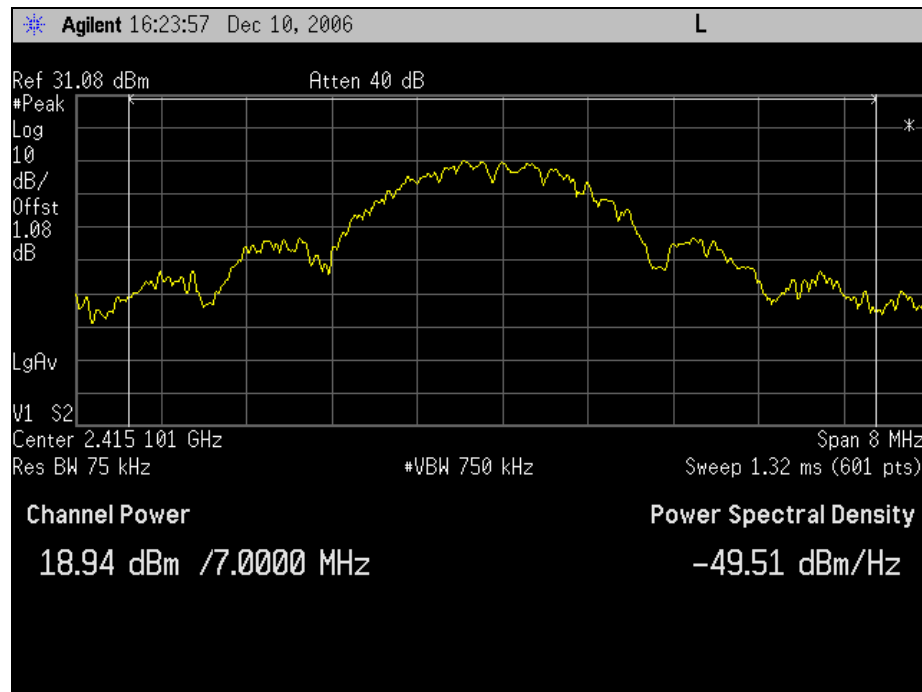
Graph 67. Peak Power Output, Channel 0



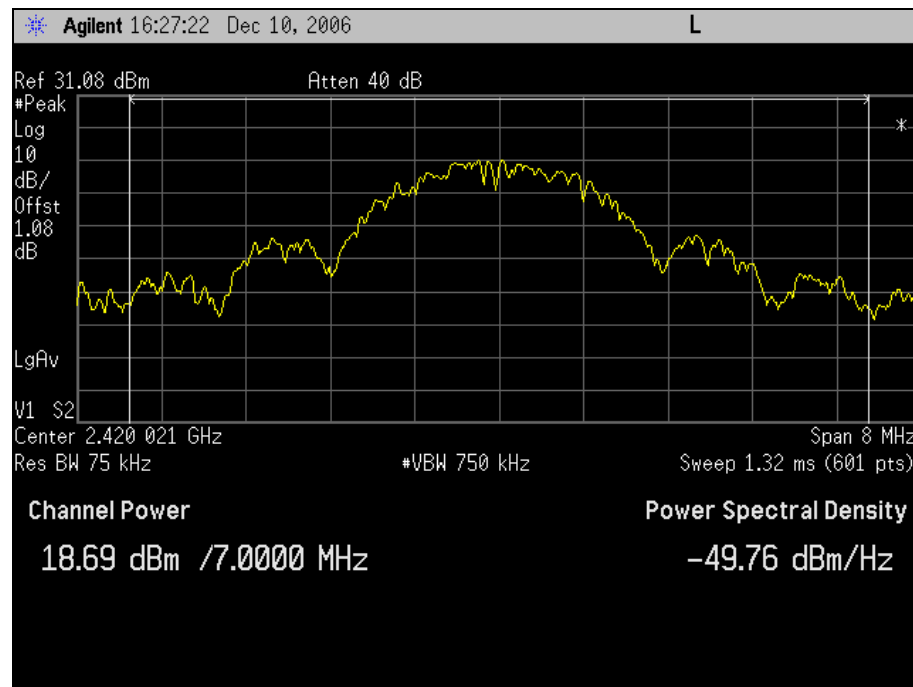
Graph 68. Peak Power Output, Channel 1



## Electromagnetic Compatibility Criteria for Intentional Radiators



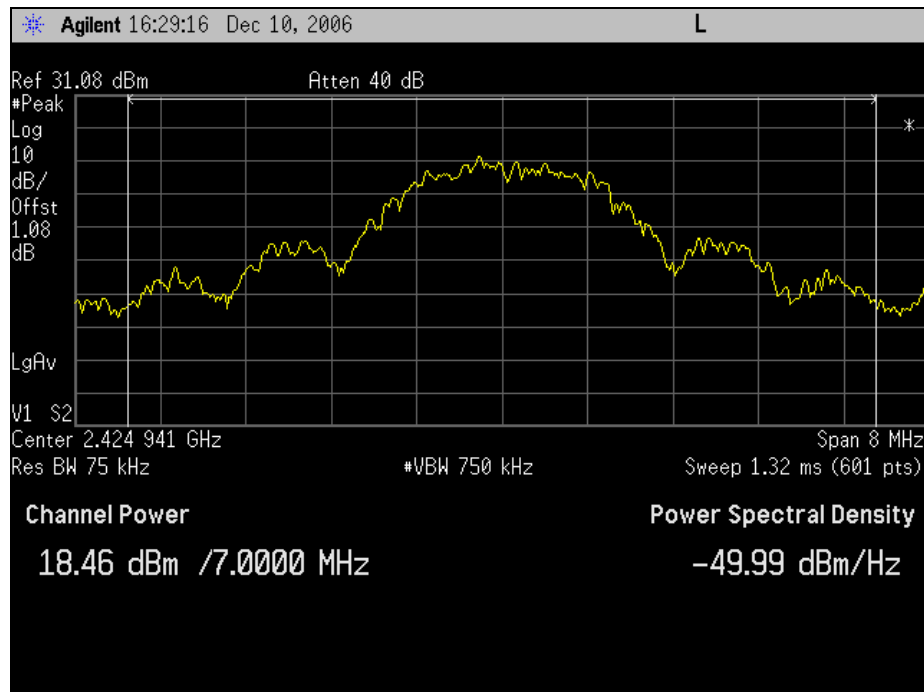
Graph 69. Peak Power Output, Channel 2



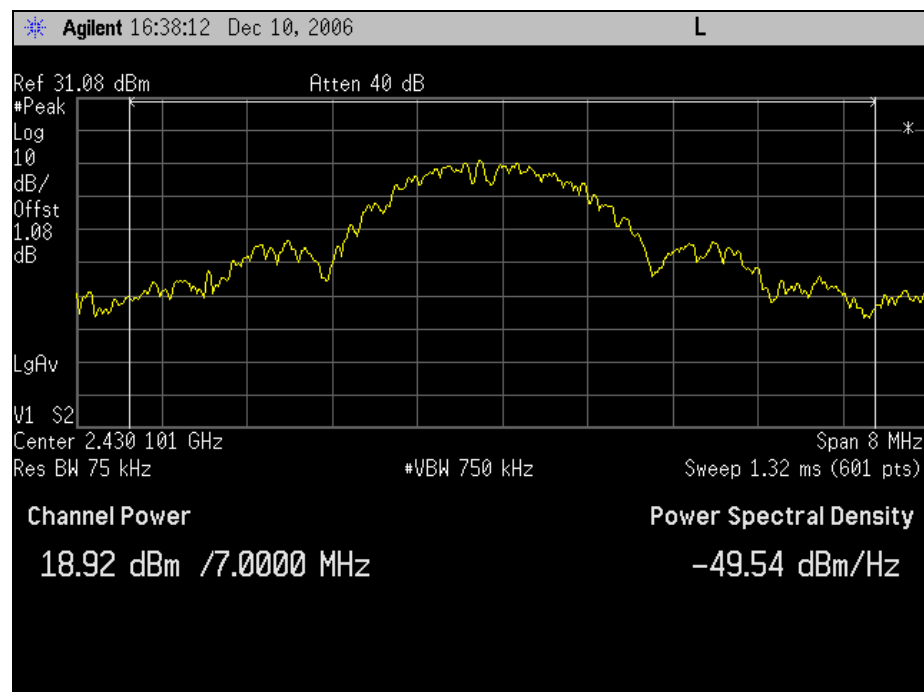
Graph 70. Peak Power Output, Channel 3



## Electromagnetic Compatibility Criteria for Intentional Radiators



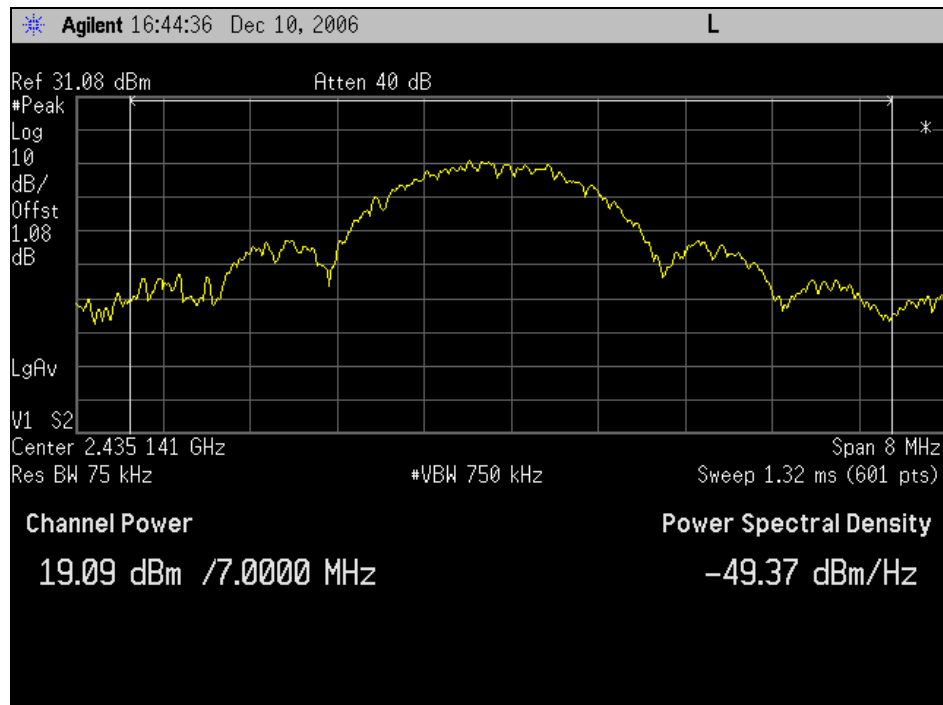
Graph 71. Peak Power Output, Channel 4



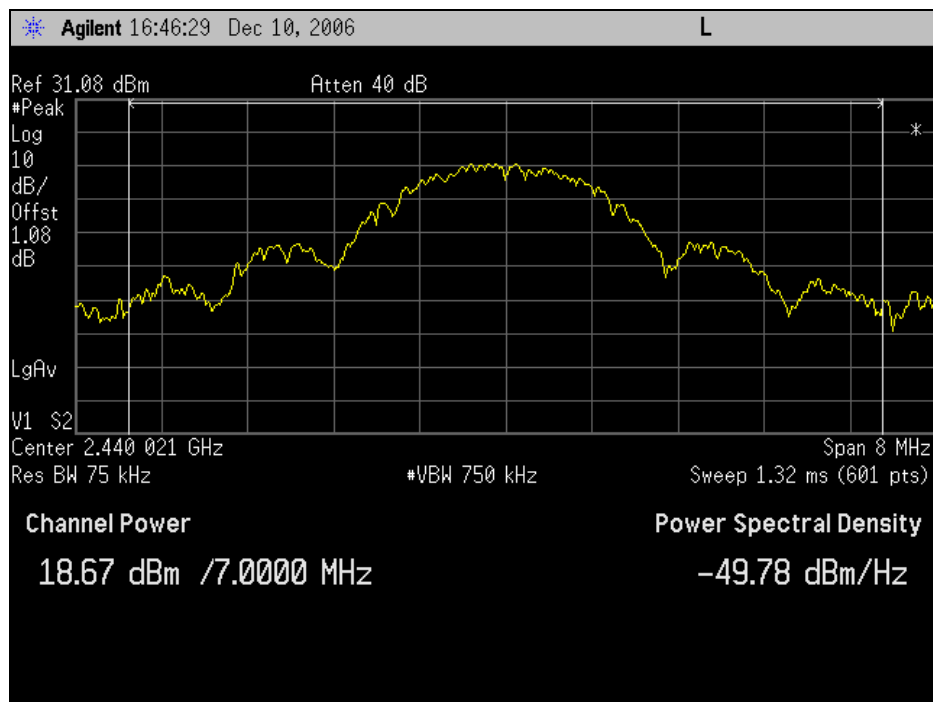
Graph 72. Peak Power Output, Channel 5



## Electromagnetic Compatibility Criteria for Intentional Radiators



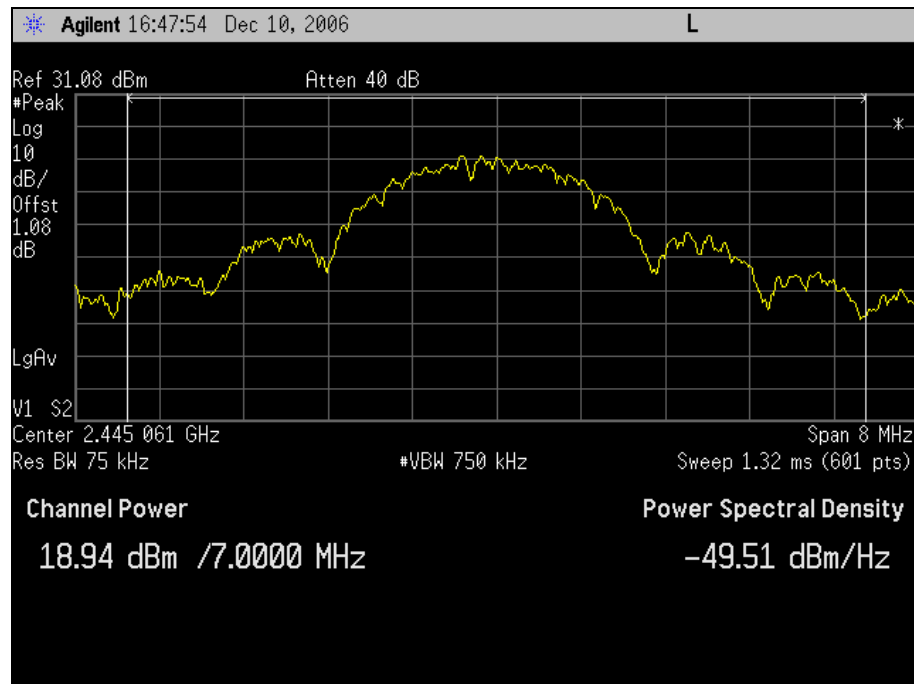
Graph 73. Peak Power Output, Channel 6



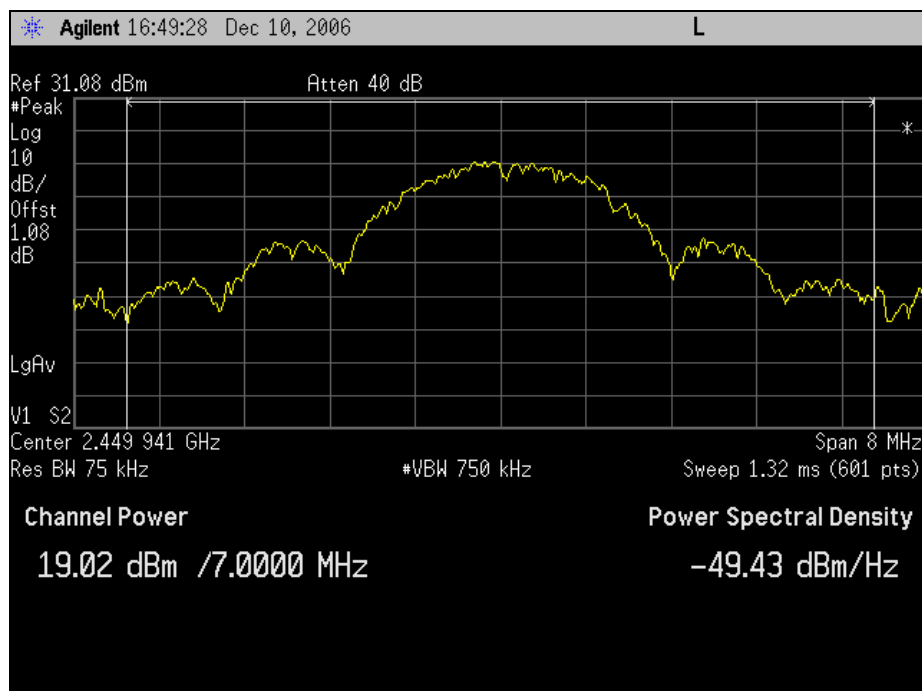
Graph 74. Peak Power Output, Channel 7



## Electromagnetic Compatibility Criteria for Intentional Radiators



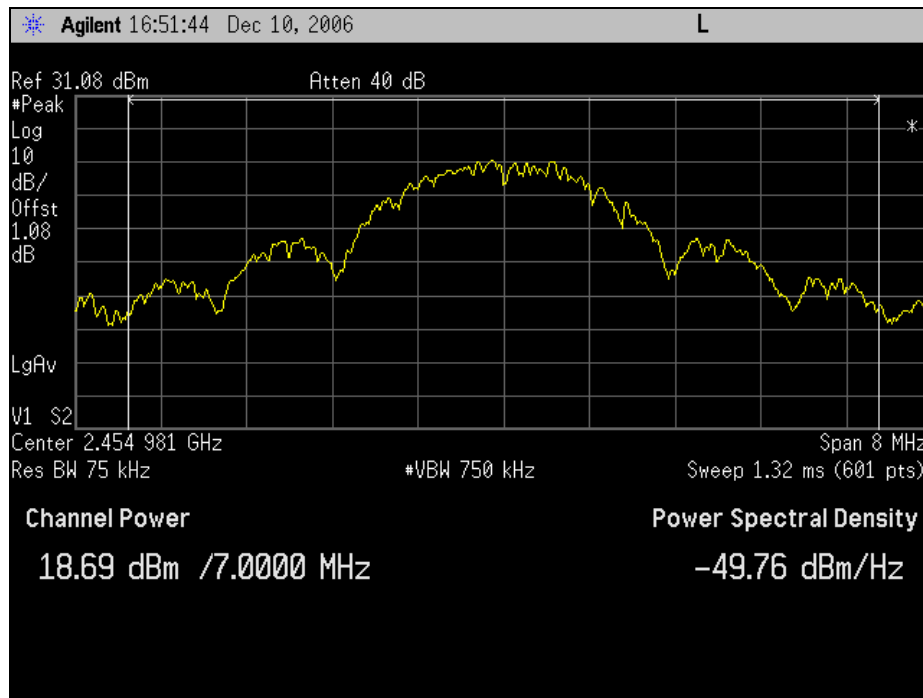
Graph 75. Peak Power Output, Channel 8



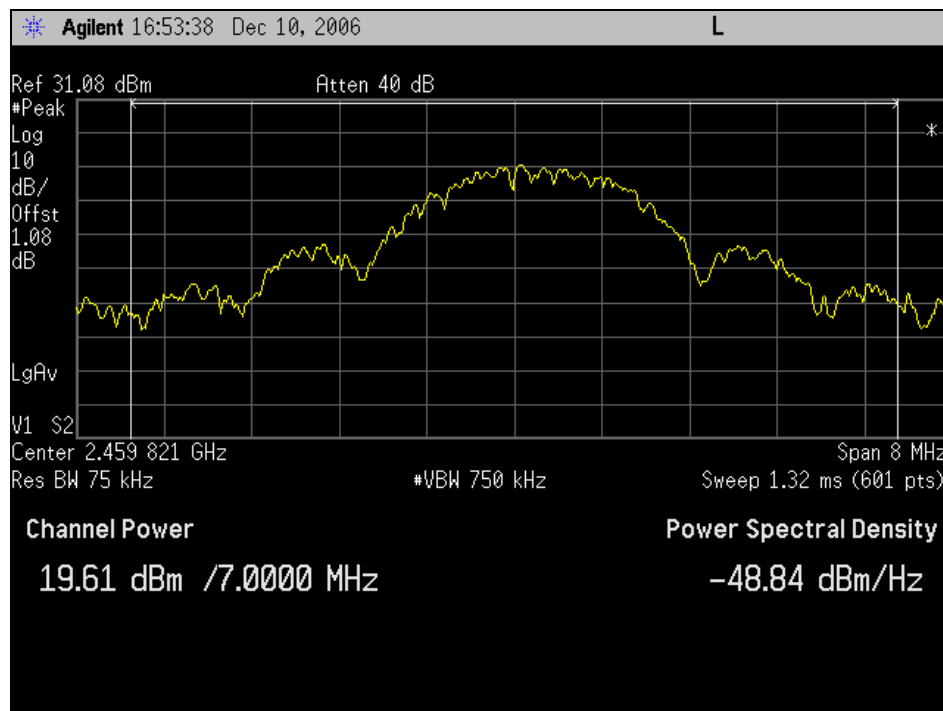
Graph 76. Peak Power Output, Channel 9



## Electromagnetic Compatibility Criteria for Intentional Radiators



Graph 77. Peak Power Output, Channel 10



Graph 78. Peak Power Output, Channel 11

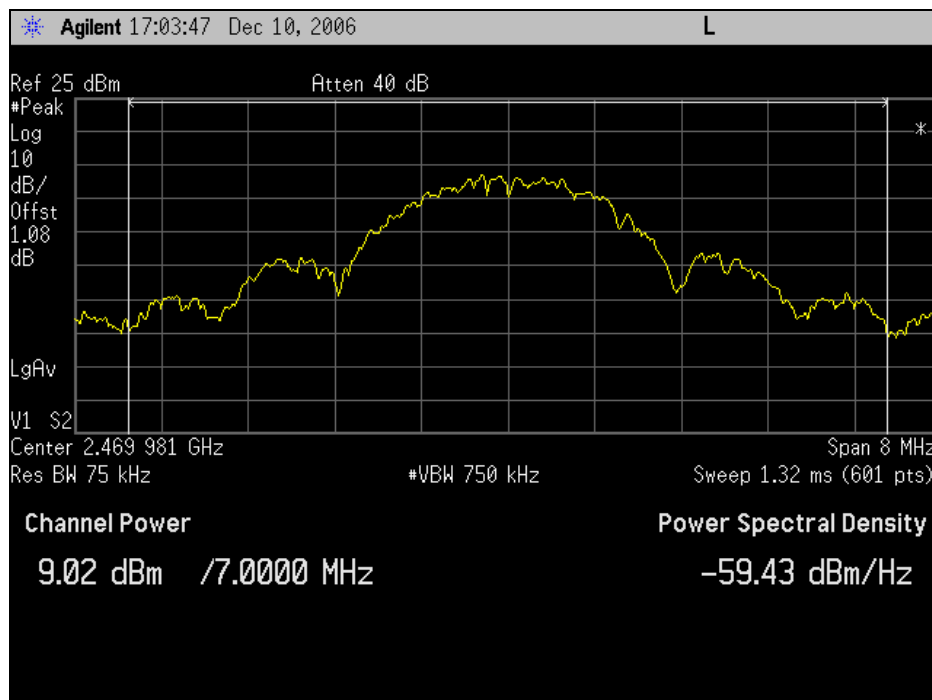




## Electromagnetic Compatibility Criteria for Intentional Radiators



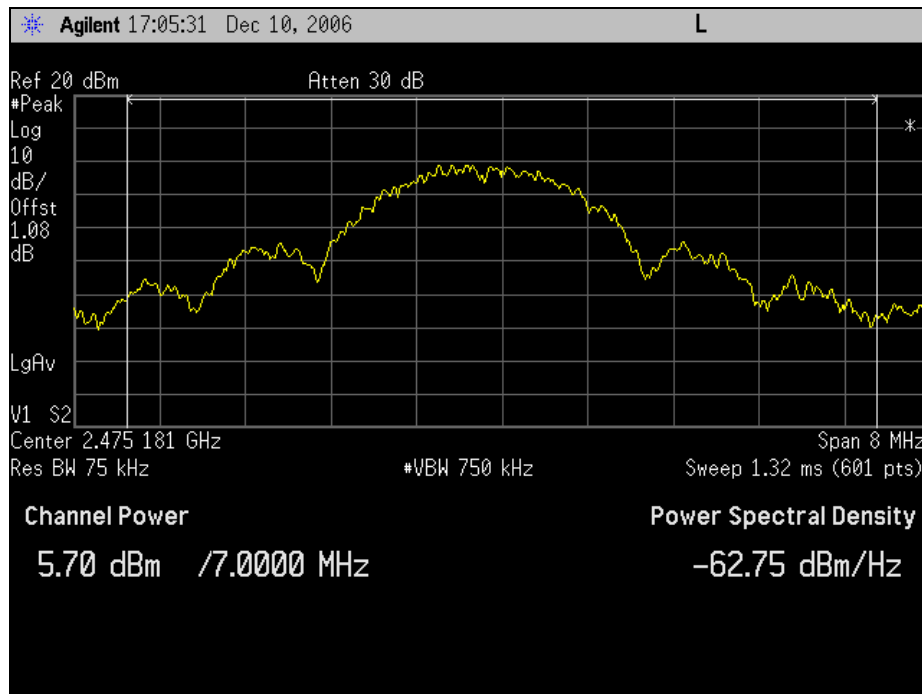
Graph 79. Peak Power Output, Channel 12



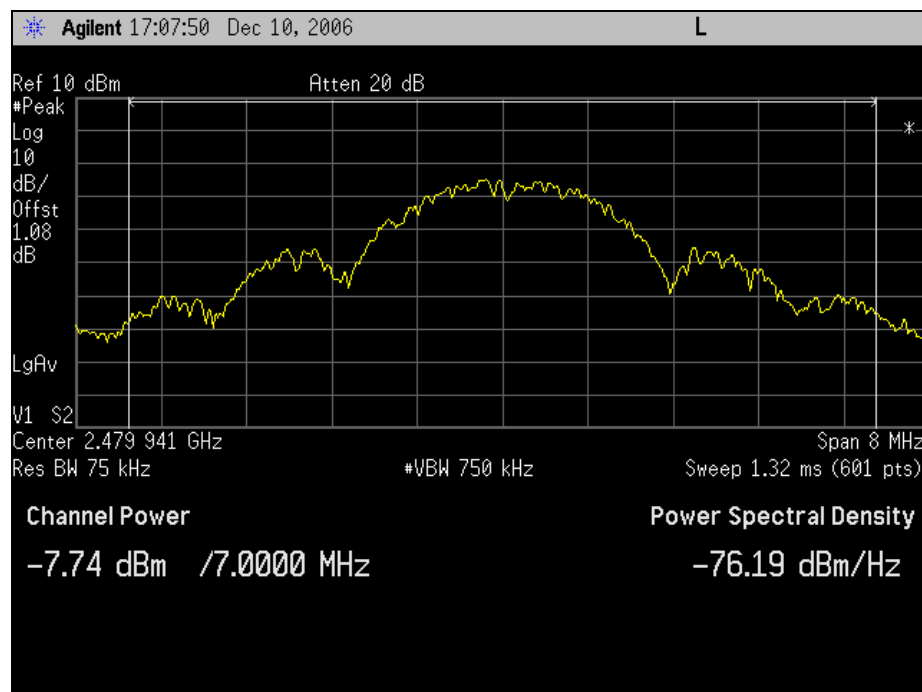
Graph 80. Peak Power Output, Channel 13



## Electromagnetic Compatibility Criteria for Intentional Radiators



Graph 81. Peak Power Output, Channel 14



Graph 82. Peak Power Output, Channel 15



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## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(b) Peak Power Output



Photograph 5. Peak Power Output, Test Setup



## 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 20. 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:** Antenna substitution was used, in order to find the maximum EIRP. The methods of TIA/EIA 603 were used. From the EIRP, the power density was calculated.

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

Frequency = 2425.566 MHz

EIRP = 21.28 dBm = 134.6 mWatts

R = 20 cm

Power Density =  $(\text{EIRP}) / (4\pi R^2) = 0.0268 \text{ mW/cm}^2$

Therefore, the EUT meets the Uncontrolled Exposure limit.

**Test Engineer:** Len Knight

**Test Date:** February 1, 2007



## Electromagnetic Compatibility Criteria for Intentional Radiators

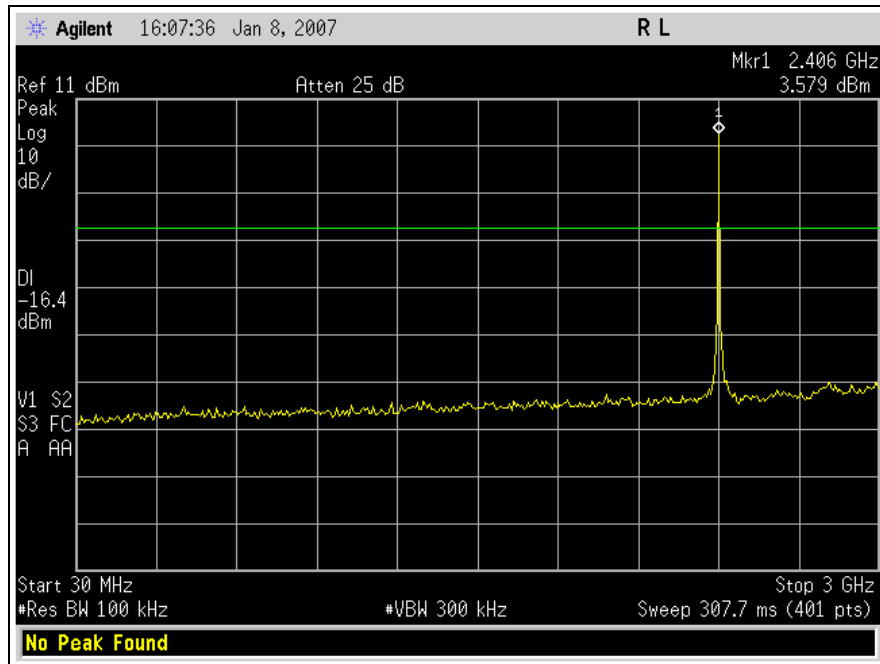
### § 15.247(d) Spurious Emissions – RF Conducted

<b>Test Requirements:</b>	<b>§15.247(d):</b> 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).
<b>Test Procedure:</b>	The EUT was configured with the control software to transmit at maximum power. The transmit output was connected to the analyzer through an attenuator. RBW = 100 kHz, VBW ≥ RBW. Testing was performed for channels 0, 7, 8, and 15.
<b>Test Results:</b>	The EUT was found compliant with the requirements of this section.
<b>Test Engineer:</b>	Len Knight
<b>Test Date:</b>	January 8, 2007 and January 12, 2007

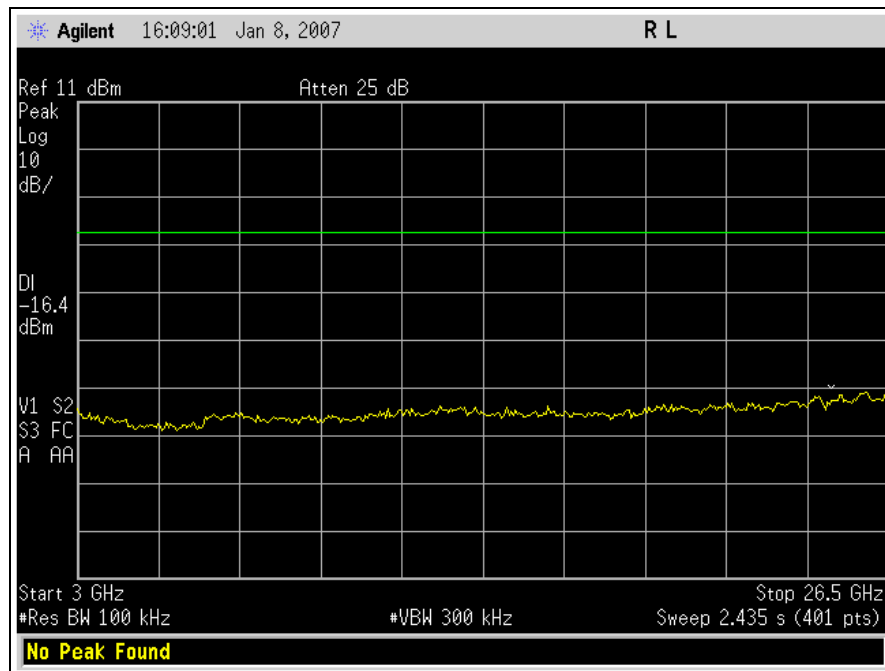


## Electromagnetic Compatibility Criteria for Intentional Radiators

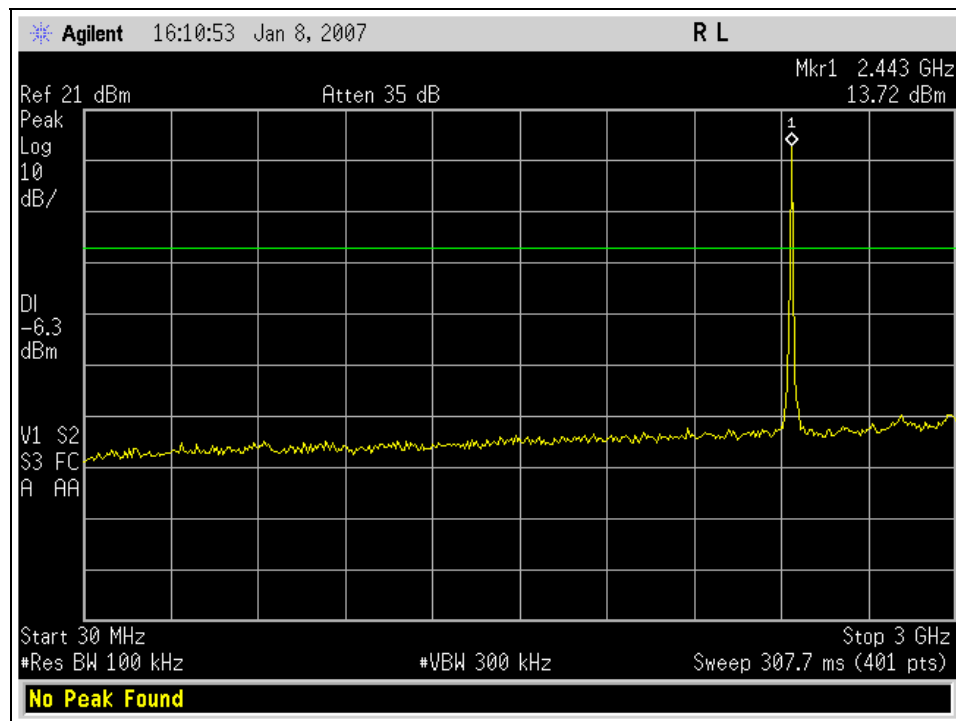
### § 15.247(d) Spurious Emissions Requirements – RF Conducted (802.11b)



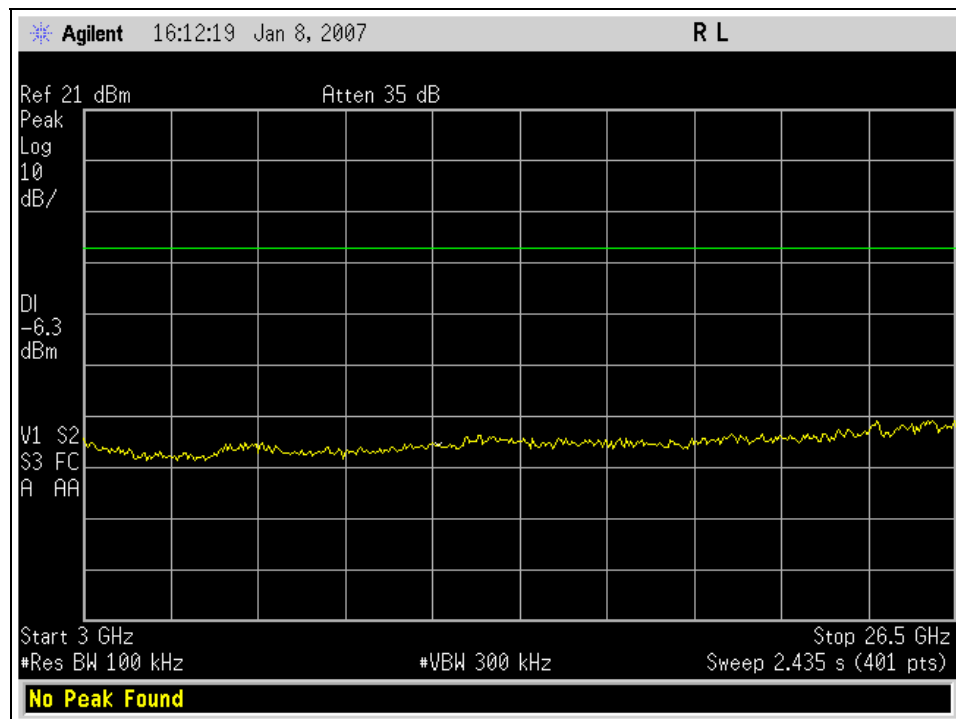
Graph 83. Spurious Conducted Emissions, Channel 0, Low



Graph 84. Spurious Conducted Emissions, Channel 0, Mid

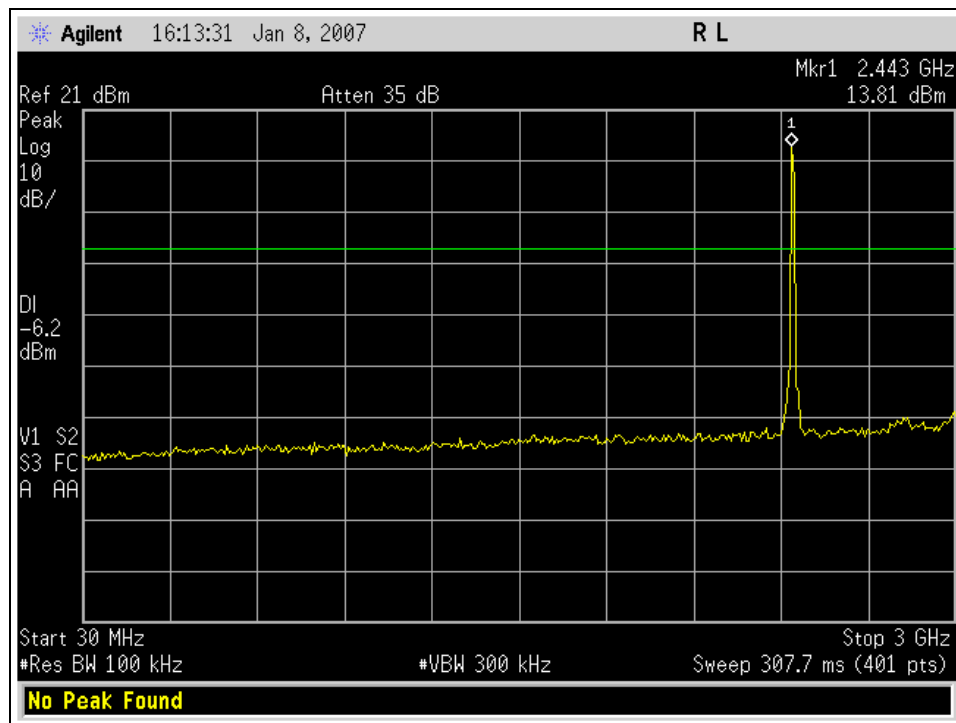


Graph 85. Spurious Conducted Emissions, Channel 7, Low

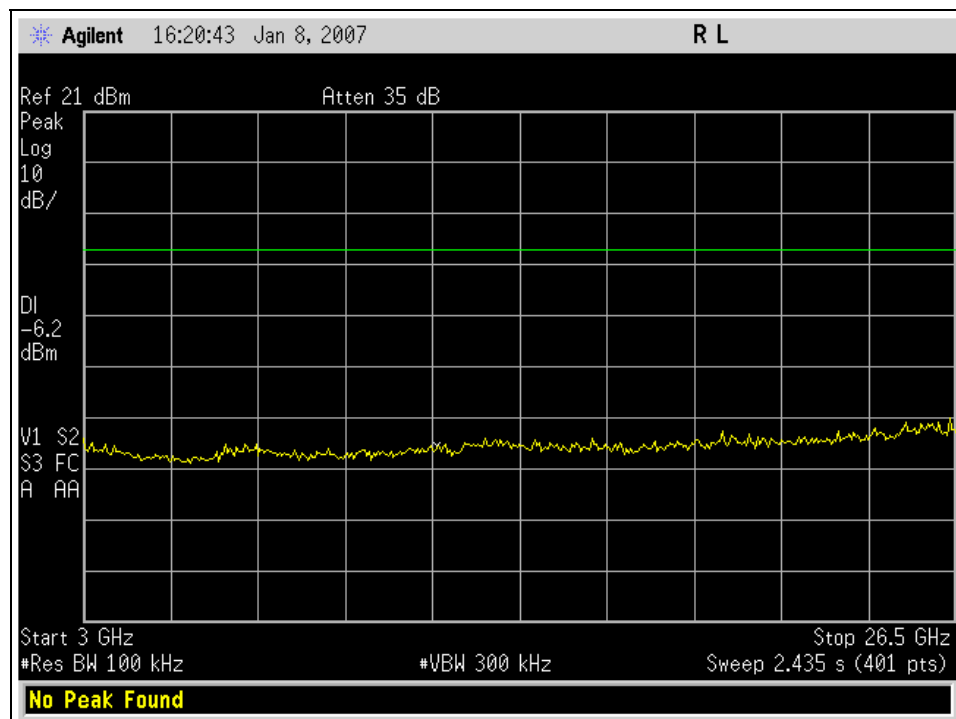


Graph 86. Spurious Conducted Emissions, Channel 7, Mid

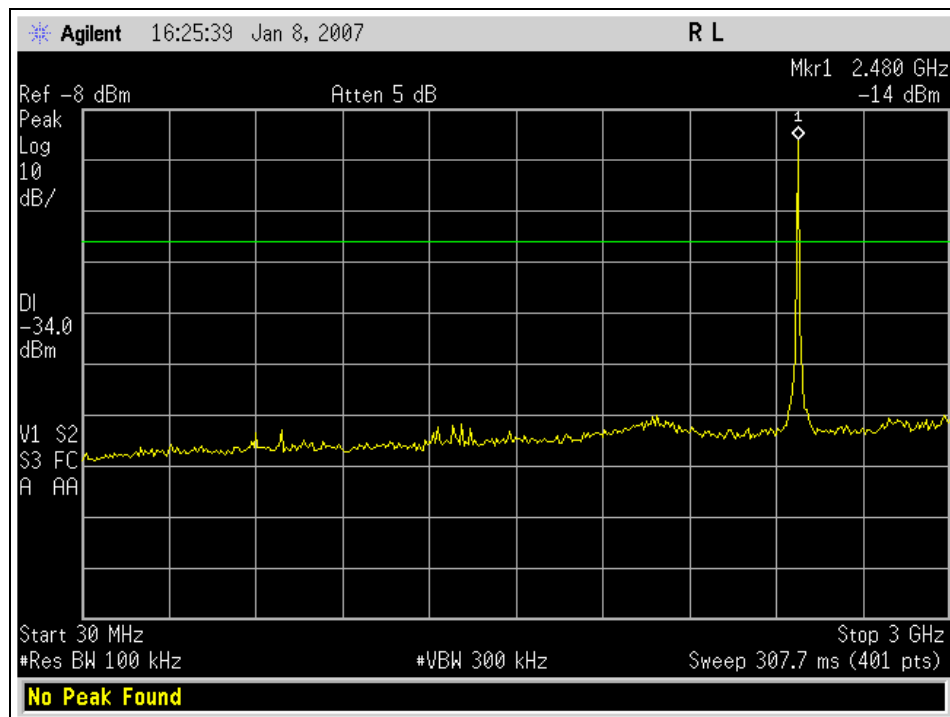




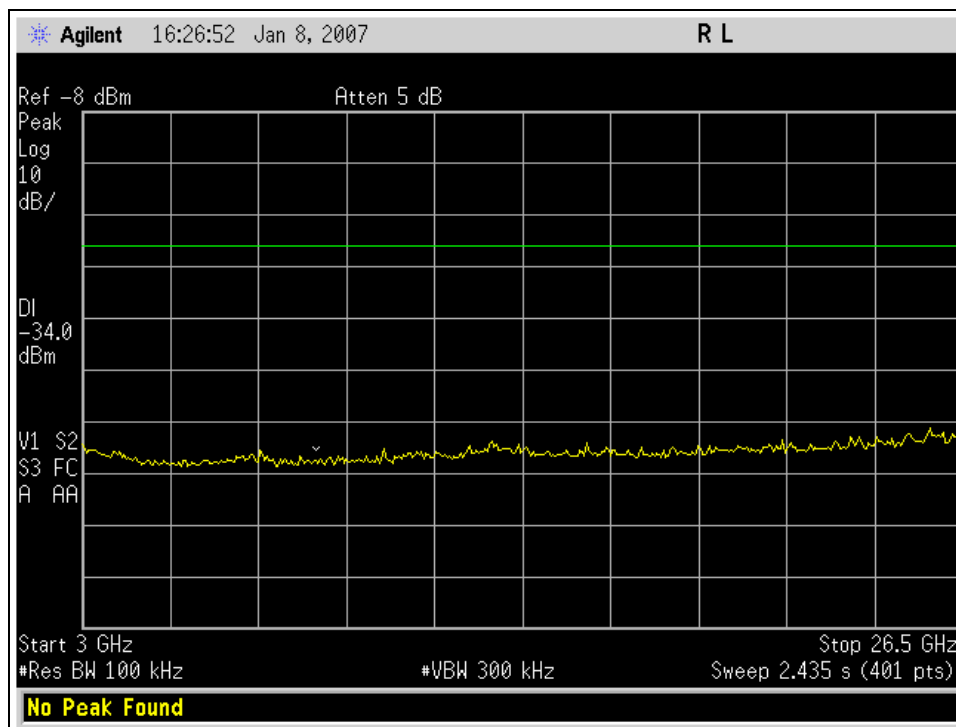
Graph 87. Spurious Conducted Emissions, Channel 8, Low



Graph 88. Spurious Conducted Emissions, Channel 8, Mid



Graph 89. Spurious Conducted Emissions, Channel 15, Low



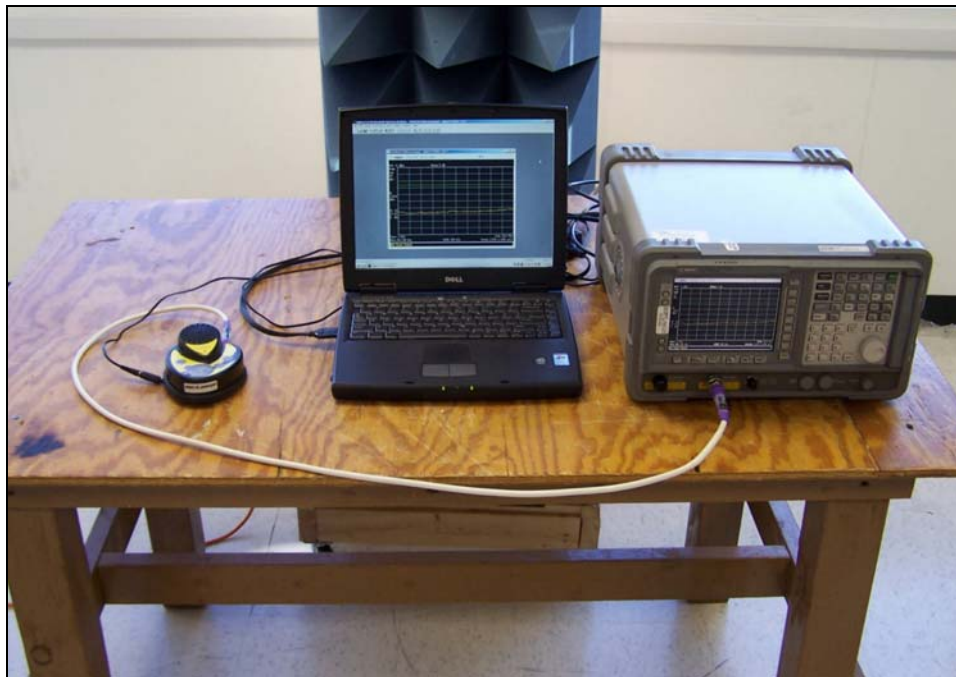
Graph 90. Spurious Conducted Emissions, Channel 15, Mid



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## Electromagnetic Compatibility Criteria for Intentional Radiators



**Photograph 6. Spurious Conducted Emissions, Test Setup**



## 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:** The transmitter was connected directly to a Spectrum Analyzer. The power level was set to the maximum level.  
RBW = 3 kHz, VBW>RBW  
Sweep = Span/ 3 kHz

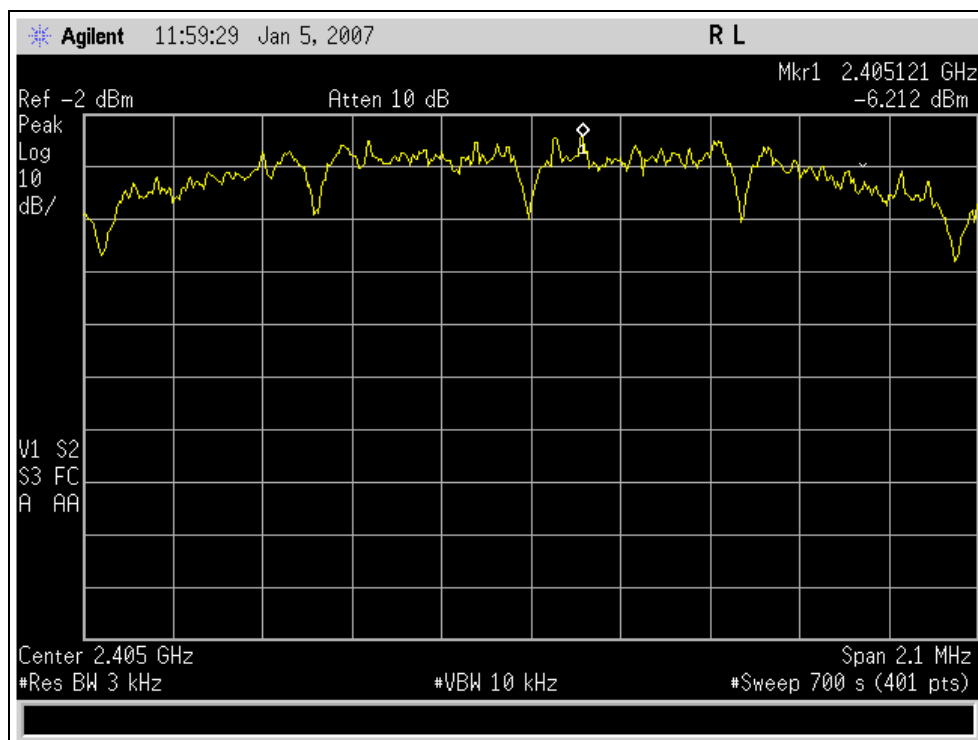
**Test Results:** Equipment complies with the peak power spectral density limits of § 15.247 (e). The peak power spectral density was determined from plots on the following page(s).

**Test Engineer:** Len Knight

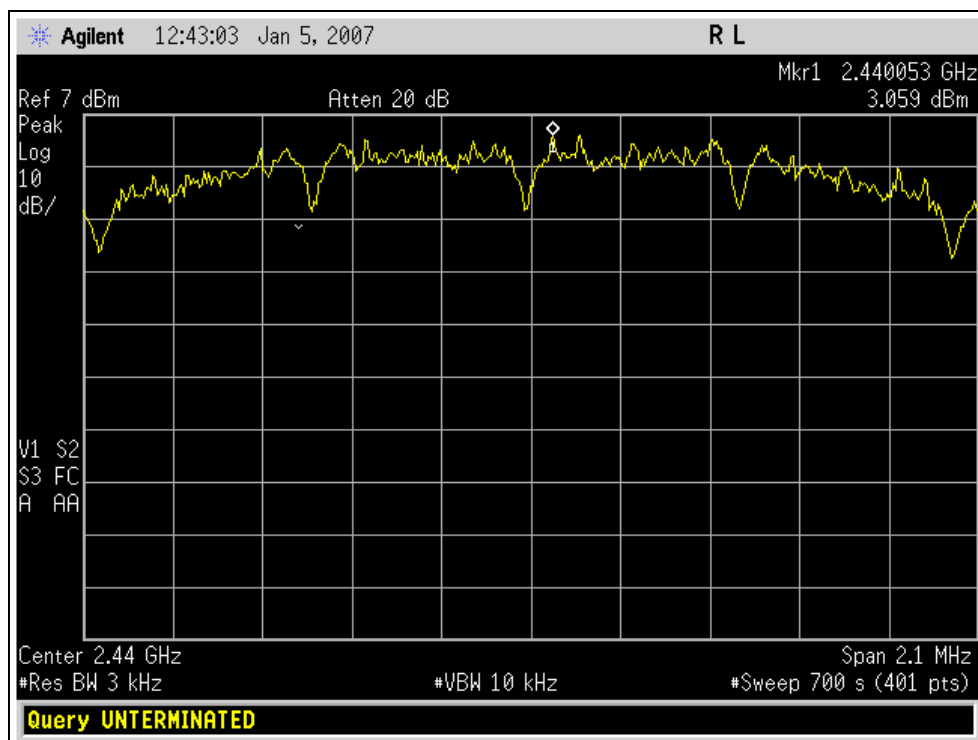
**Test Date:** January 5, 2007

Channel	Measured PPSD (dBm)	Test Limit (dBm)
1	-6.212	8
7	3.059	8
8	3.047	8
15	-23.14	8

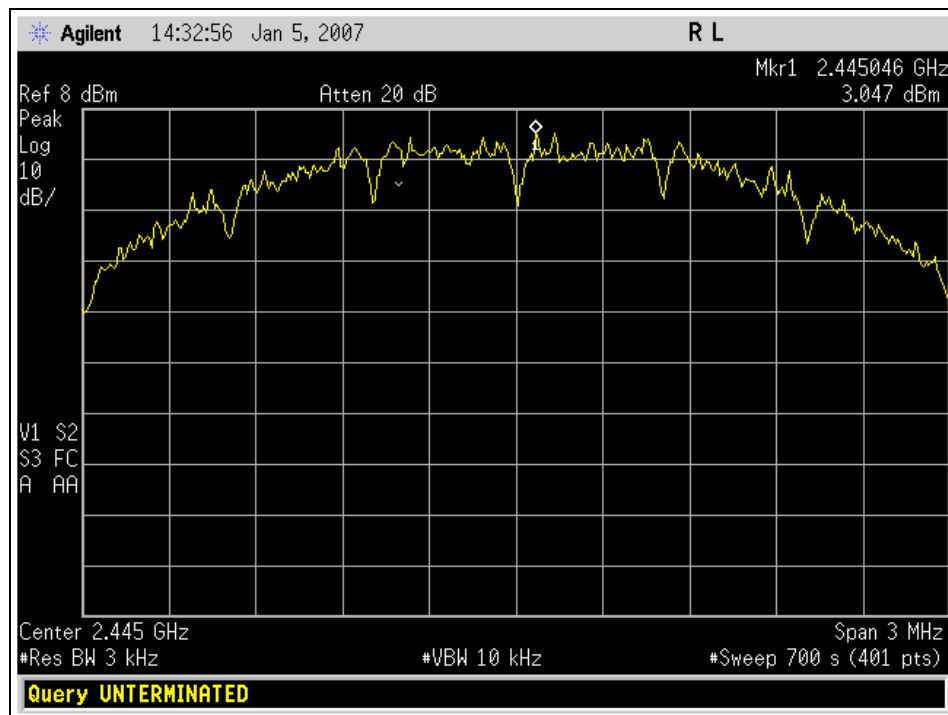
**Table 21. Peak Power Spectral Density Test Results**



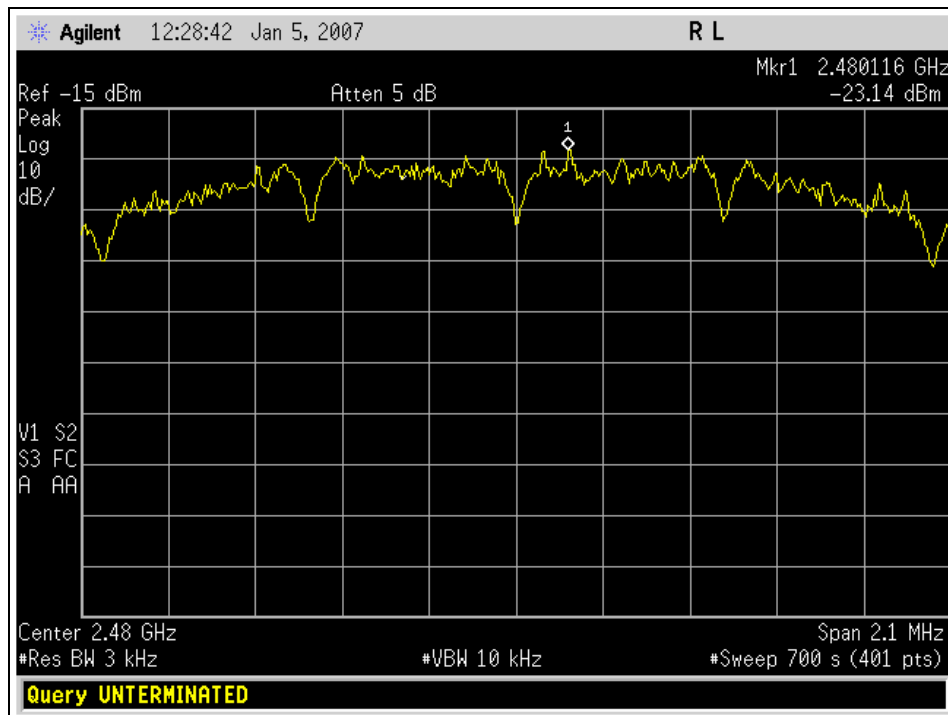
Graph 91. Peak Power Spectral Density, Channel 0



Graph 92. Peak Power Spectral Density, Channel 7



Graph 93. Peak Power Spectral Density, Channel 8



Graph 94. Peak Power Spectral Density, Channel 15

## Electromagnetic Compatibility Criteria for Intentional Radiators

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



Photograph 7. Peak Power Spectral Density Test Setup



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## IV. Test Equipment





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## 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.

Test Name: Conducted Emissions					
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4302	EMI RECEIVER	HEWLETT PACKARD	85462A	11/20/2006	11/20/2007
1T4503	SHIELDED ROOM	UNIVERSAL SHEILDING CORP	N/A	06/01/2006	06/01/2007
1T4563	LISN (10 AMP)	SOLAR ELECTRONICS	9322-50-R-10-BNC	08/30/2006	08/30/2007
1T4578	THERMO/HYGROMETER	CONTROL COMPANY	S6-627-9	09/24/2006	09/24/2008
1T4146	TRANSIENT LIMITER	HEWLETT PACKARD	11947A	SEE NOTE	
Test Name: Radiated Emissions					
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4462	THERMO-HYGROMETER	FISHER SCIENTIFIC	11-661-7D	11/08/2004	11/08/2006
1T4300	SEMI-ANECHOIC CHAMBER	EMC TEST SYSTEMS	NONE	02/17/2006	01/17/2009
1T2511	ANTENNA; HORN	EMCO	3115	07/13/2006	07/13/2007
1T4414	MICROWAVE PRE-AMPLIFIER	AH SYSTEMS	PAM-0118	SEE NOTE	
1T4303	ANTENNA; BILOG	SCHAFNER – CHASE EMC	CBL6140A	06/20/2006	06/20/2007
1T4409	EMI RECEIVER	ROHDE & SCHWARTZ	ESIB7	04/21/2006	04/21/2007
1T4554	THERMO-HYGROMETER	CONTROL COMPANY	56-627-9	04/11/2006	04/11/2008
1T4323	HARMONIC MIXER	HEWLETT PACKARD	11970K	SEE NOTE	
Test Name: 6 dB Bandwith					
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4351	SPECTRUM ANALYZER	AGILENT	E7405A	10/13/2006	10/13/2007
1T4553	THERMO-HYGROMETER	CONTROL COMPANY	56-627-9	03/03/2006	03/03/2008
1T4503	SHIELDED ROOM	UNIVERSAL SHEILDING CORP	N/A	06/01/2006	06/01/2007
Test Name: Peak Power Output					
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4503	SHIELDED ROOM	UNIVERSAL SHEILDING CORP	N/A	06/01/2006	06/01/2007
US42070103	PSA SERIES SPECTRUM ANALYZER	AGILENT	E4448A	01/12/2006	01/12/2007
Test Name: RF Exposure					
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4351	EMC ANALYZER	AGILENT	E7405A	10/04/2005	10/04/2006
US42070103	PSA SERIES SPECTRUM ANALYZER	AGILENT	E4448A	01/12/2006	01/12/2007
1T2511	ANTENNA; HORN	EMCO	3115	07/13/2006	07/13/2007



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Test Name: Spurious Emissions					
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4414	MICROWAVE PRE-AMPLIFIER	AH SYSTEMS	PAM-0118	SEE NOTE	
1T4480	MILITARY CHAMBER 20 x 20 x 12	ETS LINDGREN	SERIES 80	SEE NOTE	
US42070103	PSA SERIES SPECTRUM ANALYZER	AGILENT	E4448A	01/12/2006	01/12/2007
Test Name: Peak Power Spectral Density					
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4351	SPECTRUM ANALYZER	AGILENT	E7405A	10/13/2006	10/13/2007
1T4553	THERMO-HYGROMETER	CONTROL COMPANY	56-627-9	03/03/2006	03/03/2008
1T4503	SHIELDED ROOM	UNIVERSAL SHEILDING CORP	N/A	06/01/2006	06/01/2007

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



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## **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 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.



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## VI. Exhibits



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## Exhibit A, Hopping Capability Requirements



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## **Exhibit B, Non-Coordination Requirements**



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# End of Report