



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

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November 27, 2007

Rajant Corporation
400 E. King Street
Malvern, PA 19355

Dear Brian Hassick,

Enclosed is the EMC test report for compliance testing of the Rajant Corporation, Breadcrumb SE 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.

Jennifer Warnell
Documentation Department

Reference: (\Rajant Corporation\EMC23058-FCC247 Rev. 1)

DOC EMC702 9/13/2007

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Rajant Corporation
Breadcrumb SE

CFR Title 47, Part 15, Subpart C

Electromagnetic Compatibility Test Report

for the

**Rajant Corporation
Breadcrumb SE**

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

MET Report: EMC23058-FCC247 Rev. 1

November 27, 2007

Prepared For:

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

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



Rajant Corporation
Breadcrumb SE

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

Shawn McMillen,
Wireless Coordinator, Electromagnetic Compatibility Lab



Rajant Corporation
Breadcrumb SE

CFR Title 47, Part 15, Subpart C

Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	November 21, 2007	Initial Issue.
1	November 27, 2007	Removed duplicate graphs.



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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 μ A	Decibels above one microamp
dB μ V	Decibels above one microvolt
dB μ A/m	Decibels above one microamp per meter
dB μ 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
μ H	microhenry
μ	microfarad
μ 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



1.1 Purpose of Test

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

1.2 Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, §15.247, in accordance with Rajant Corporation, purchase order number 2007224. 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



II. Equipment Configuration



2.1 Overview

MET Laboratories, Inc. was contracted by Rajant Corporation to perform testing on the Breadcrumb SE, under Rajant Corporation's purchase order number 2007224.

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

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

Model(s) Tested:	Breadcrumb SE	
Model(s) Covered:	Breadcrumb SE	
EUT Specifications:	Primary Power: 12 VDC through a 120 VAC, 60 Hz – AC to DC Converter	
	Secondary Power: 9 VDC Li-Ion Battery	
	FCC ID: VJA-SE	
	Type of Modulations:	DSSS, BPSK, QPSK, CCK
	Peak RF Conducted Output Power:	25.1 dBm
	EUT TX Frequency Ranges:	2412-2462 MHz
Analysis:	The results obtained relate only to the item(s) tested.	
Evaluated by:	Len Knight	
Date(s):	November 21, 2007	



2.2 References

CFR 47, Part 15, Subpart C	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: General Rules and Regulations, Allocation, Assignment, and Use of Radio Frequencies
CFR 47, Part 15, Subpart B	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
ANSI C63.4:2003	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI/NCSL Z540-1-1994	Calibration Laboratories and Measuring and Test Equipment - General Requirements
ANSI/ISO/IEC 17025:2000	General Requirements for the Competence of Testing and Calibration Laboratories

2.3 Test Site

All testing was performed at MET Laboratories, Inc., 914 West Patapsco Avenue, Baltimore, MD 21230. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

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

2.4 Description of Test Sample

The Breadcrumb SE, Equipment Under Test (EUT), is a portable networking device that supports wired and wireless routing, and 802.11b access point/bridging/meshing functionality. It can be powered from an internal battery, an external AC/DC power supply, or a flying lead power cable.

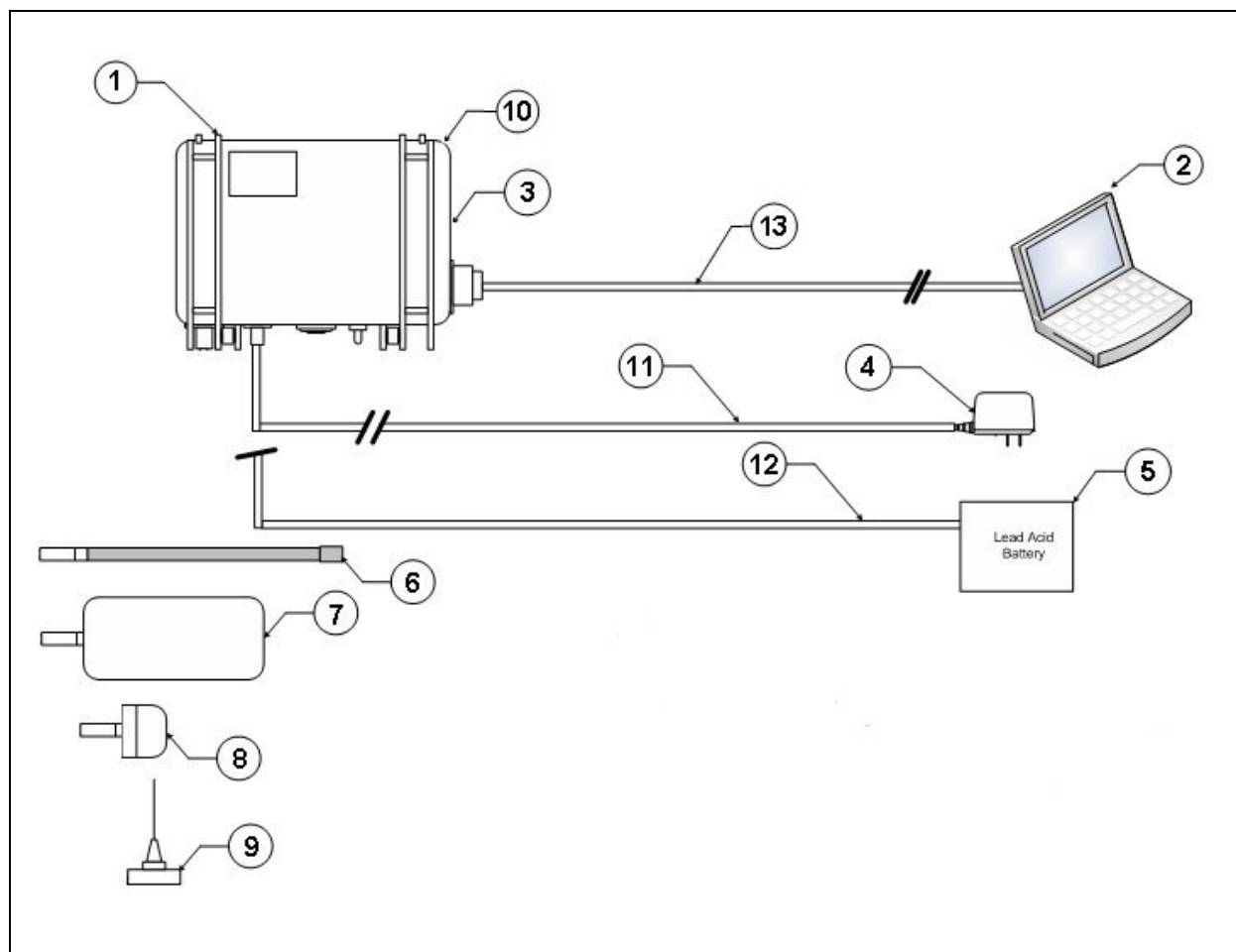


Figure 1. Block Diagram of Test Configuration



2.5 Equipment Configuration

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

Ref. ID	Name / Description	Manufacturer	Model Number	Serial Number
1	SE UNIT	RAJANT CORPORATION	SE	SE2E10-1280
2	LAPTOP	IBM	THINKPAD	11605K6451ZFX082091JX
3	INITIAL RB-270 LI-ION BATTERY	INITIAL DVD	RB-270	N/A
4	ACT TO DC POWER CONVERTER	CUI INC.	DMS120085-P5-IC	N/A
5	LEAD ACID BATTERY	N/A	N/A	N/A
6	OMNI ANTENNA, 12 DBI	PACIFIC WIRELESS	OD24M-12	N/A
7	120 DEG SECTOR, 9 DBI	PACIFIC WIRELESS	SA24-120-9	N/A
8	CUPCAKE, 3 DBI	WIFI PLUS	WFP0200507	N/A
9	MAGNETIC MOUNT, OMNI, 7 DBI	PACIFIC WIRELESS	MA24-7	N/A
10	11 MBPS WIRELESS LAN CARD	ZCOMAX	XI-325	FCC ID: M47-000325

Table 2. Equipment Configuration

2.6 Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Point
11	POWER CONNECTOR	20 GA., 2 COND.	1	~6.0FT	N	110 AC MAINS
12	POWER CONNECTOR	2PIN VEHICLE CABLE	1	~12.0FT	N	LEAD ACID BATTERY
13	ETHERNET PORT	CAT 5	1	~6 FT	N	LAPTOP

Table 3. Ports and Cabling Information

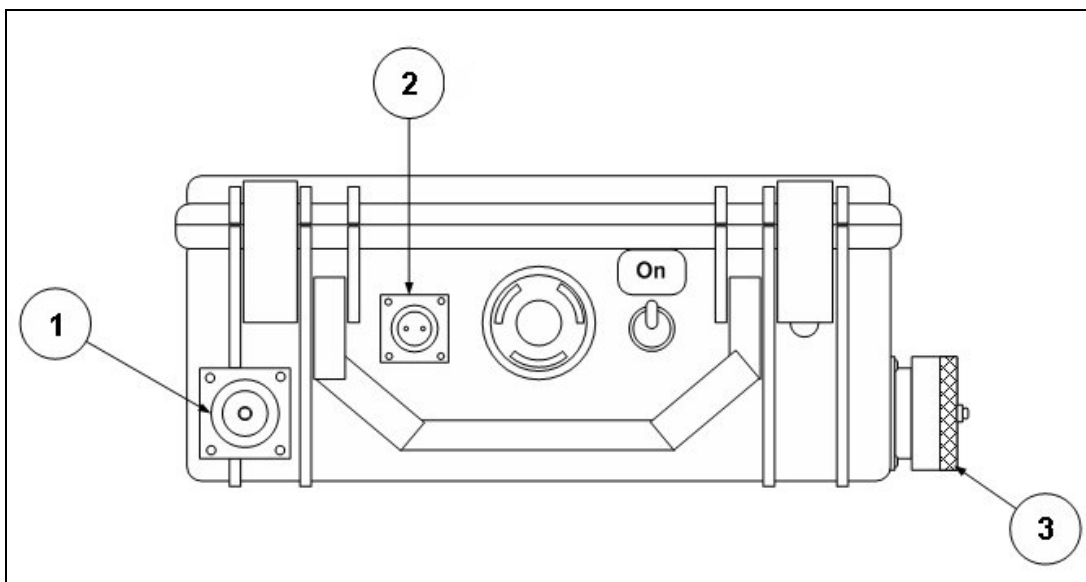


Figure 2. Port Identification

Ref. ID	Port Name
1	RF Port
2	Power Connector
3	Ethernet Port



2.7 Mode of Operation

The EUT simulated a network packing routing operation internally and exercised the radio transceiver cards by forcing them into a mode where they continuously transmitted. One card continuously transmitted on Channel 1 while the other transmitted on Channel 11.

Internal software was used in order to control the individual cards. The following commands issued would put the cards into continuous transmit:

```
fcctest 2 wlan 0 – 88
```

```
fcctest 2 wlan 1 – 88
```

2.8 Modifications

a) Modifications to EUT

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

2.9 Disposition of EUT

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



III. Electromagnetic Compatibility Criteria for Intentional Radiators



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 Antenna Requirement

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

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

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

Results: The EUT and accompanying antennas are for professional use only. Because it is intended for professional installation, it meets the requirements of this section. The EUT is therefore compliant with §15.203.

Test Engineer(s): Len Knight

Test Date(s): 11/05/07



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.205 Band Edge Emissions

Test Requirement(s): § 15.205 (a): Except as shown in paragraph (d) of 15.205 **Restricted bands of operation**, only spurious emissions are permitted in any of the frequency bands specified in Table 4:

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 4. Restricted Bands of Operation from FCC Part 15, § 15.205

Test Procedure: The EUT was set up at maximum power. One card transmitted at Channel 1 while the other transmitted at channel 11. The card which transmits on Channel 11 only connects to the internal 2 dBi antenna. Channel 1 card can connect to an internal 2 dBi antenna or to an external antenna. It was verified that the channels tested were within the band 2400–2480 MHz and not infringing upon the restricted bands.

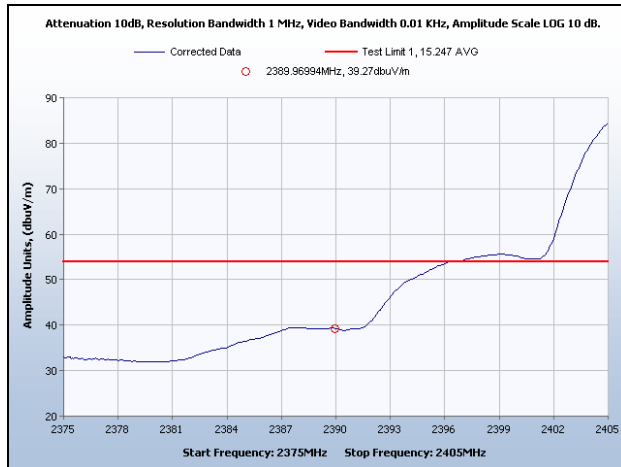
Test Results: The EUT was compliant with the requirements of this section.

Test Engineer(s): Len Knight

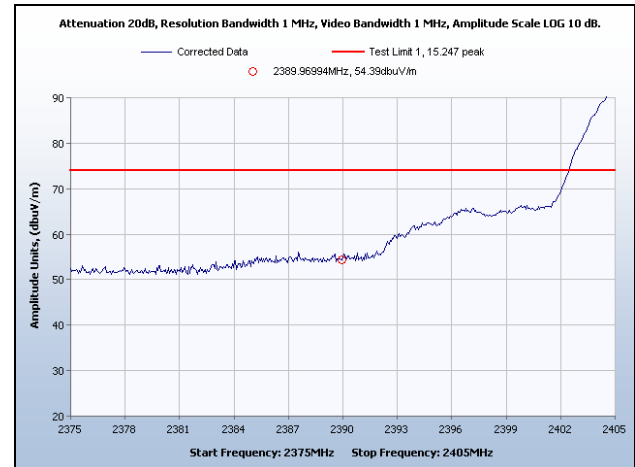
Test Date(s): 11/6/07



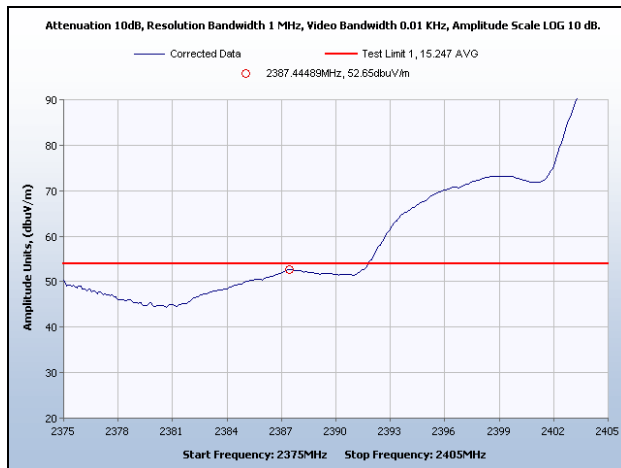
Band Edge Emissions – Test Results



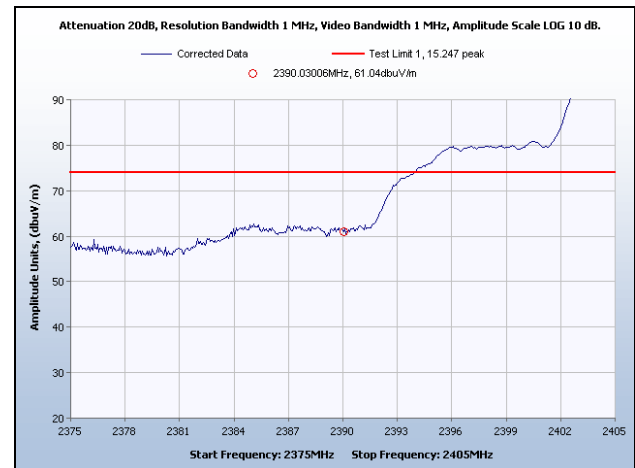
Band Edge Emissions, Channel 1, 7 dBi Mag., Average



Band Edge Emissions, Channel 1, 7 dBi Mag., Peak



Band Edge Emissions, Channel 1, 9 dBi Sector, Average

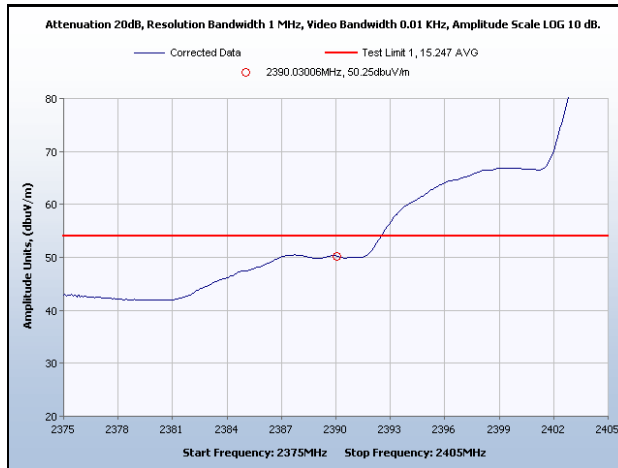


Band Edge Emissions, Channel 1, 9 dBi Sector, Peak

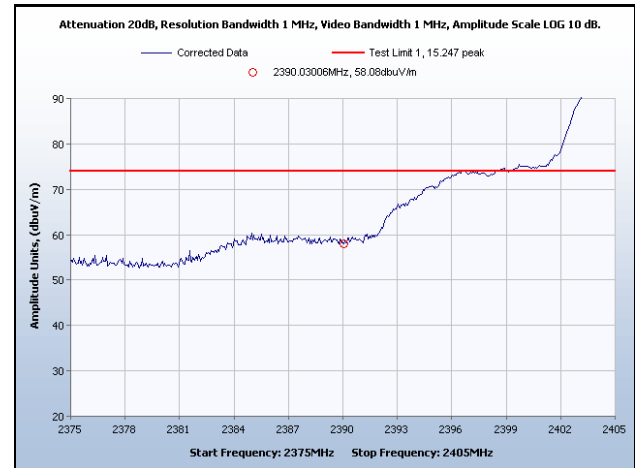


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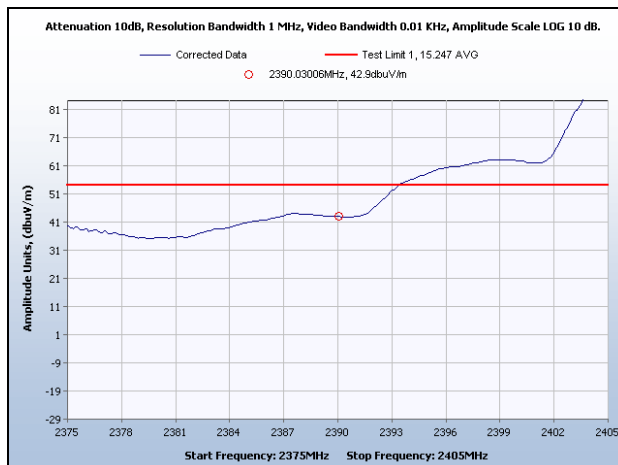
Electromagnetic Compatibility
Criteria for Intentional Radiators
CFR Title 47, Part 15, Subpart C



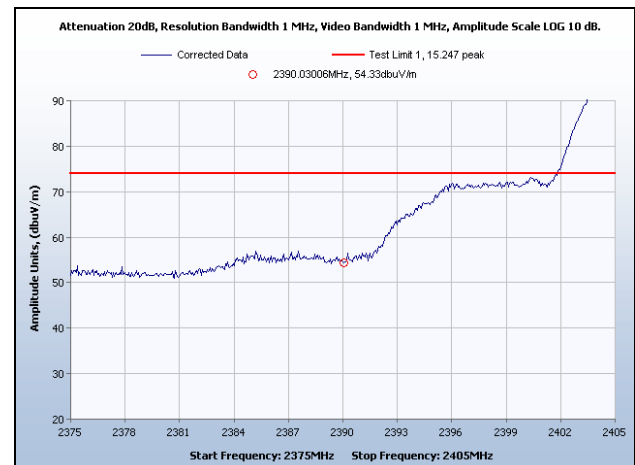
Band Edge Emissions, Channel 1, 12 dBi Omni, Average



Band Edge Emissions, Channel 1, 12 dBi Omni, Peak



Band Edge Emissions, Channel 1, Cupcake Antenna, Average

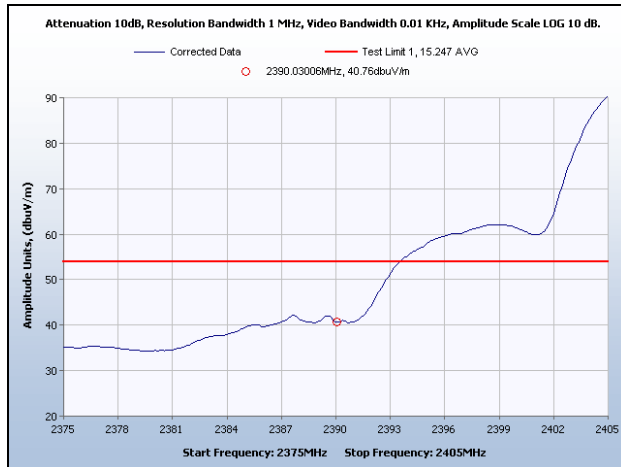


Band Edge Emissions, Channel 1, Cupcake Antenna, Peak

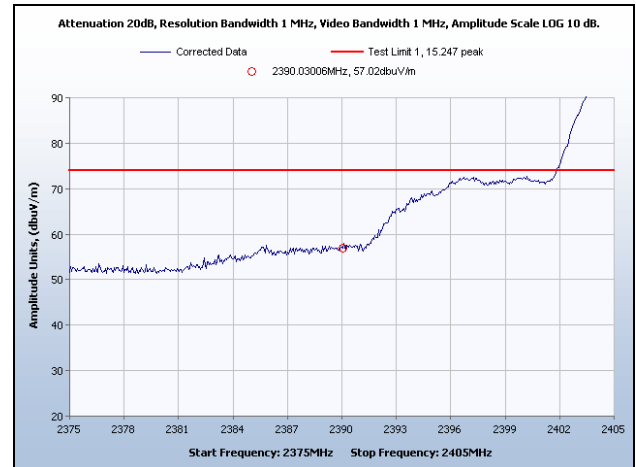


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Breadcrumb SE

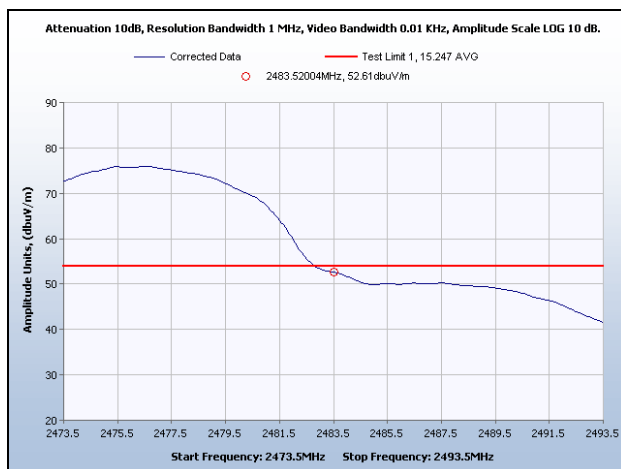
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Criteria for Intentional Radiators
CFR Title 47, Part 15, Subpart C



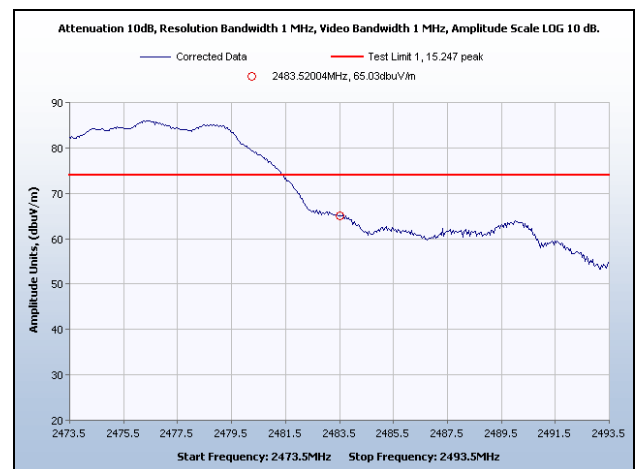
Band Edge Emissions, Channel 1, Internal 2 dBi Antenna, Average



Band Edge Emissions, Channel 1, Internal 2 dBi Antenna, Peak



Band Edge Emissions, Channel 11, Internal 2 dBi Antenna, Average



Band Edge Emissions, Channel 11, Internal 2 dBi Antenna , Peak



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 μ H/50 Ω 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 μ V)	
	Quasi-Peak	Average
* 0.15- 0.45	66 - 56	56 - 46
0.45 - 0.5	56	46
0.5 - 30	60	50

Table 5. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

Test Procedure: The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a screen room. The method of testing, test conditions, and test procedures of ANSI C63.4 were used. The EUT was powered through a 50 Ω /50 μ H LISN. An EMI receiver, connected to the measurement port of the LISN, scanned the frequency range from 150 kHz to 30 MHz in order to find the peak conducted emissions. All peak emissions within 6 dB of the limit were re-measured using a quasi-peak and/or average detector as appropriate.

Test Results: The EUT was 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): 09/20/07

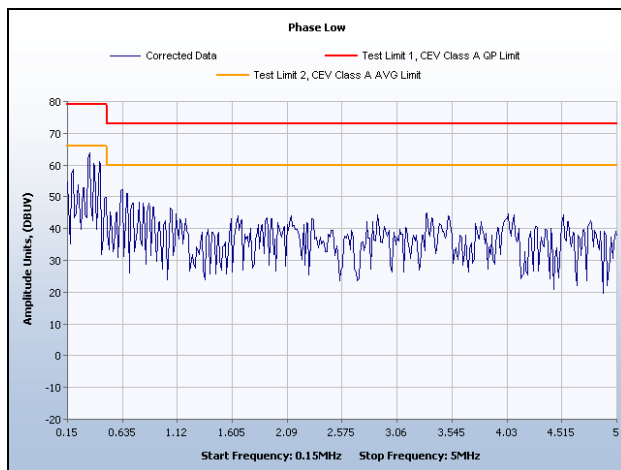


Electromagnetic Compatibility Criteria for Intentional Radiators

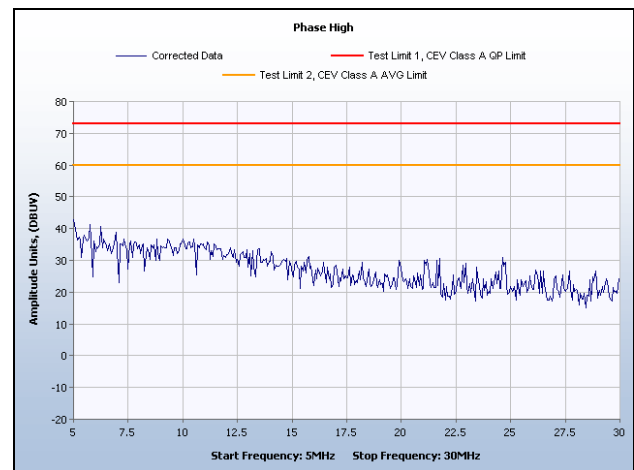
§ 15.207 Conducted Emissions Limits

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
0.3364	63.21	0.15	63.36	79	-15.79	51.18	0.15	51.33	66	-14.67
0.3819	59.48	0.15	59.63	79	-19.52	48.53	0.15	48.68	66	-17.32
0.4291	59.57	0.15	59.72	79	-19.43	48.11	0.15	48.26	66	-17.74

Table 6. Conducted Emissions - Voltage, Phase (120 VAC)



Conducted Emissions, Phase Low



Conducted Emissions, Phase High

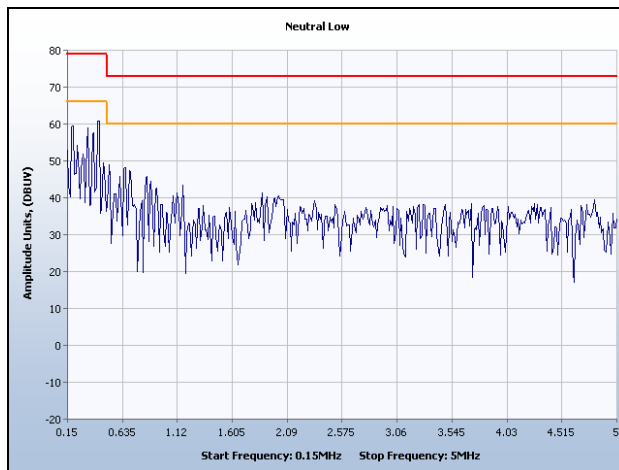


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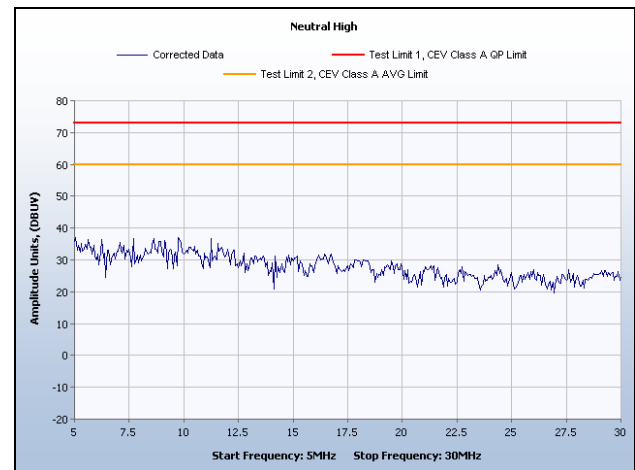
Electromagnetic Compatibility
Criteria for Intentional Radiators
CFR Title 47, Part 15, Subpart C

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
0.3368	63.48	0.15	63.63	79	-15.52	51.45	0.15	51.6	66	-14.4
0.3863	60.58	0.15	60.73	79	-18.42	47.12	0.15	47.27	66	-18.73
0.4283	60.26	0.15	60.41	79	-18.74	47.1	0.15	47.25	66	-18.75

Table 7. Conducted Emissions - Voltage, Neutral (120 VAC)



Conducted Emissions, Neutral Low



Conducted Emissions, Neutral High



Photograph 1. Conducted Emissions, Test Setup



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.205 § 15.209 Radiated Emissions – Unintentional Spurious

Test Requirement(s): § 15.205 (a): Except as shown in paragraph (d) of 15.205 Restricted bands of operation, only spurious emissions are permitted in any of the frequency bands specified in Error! Reference source not found.:

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 8. 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 9. Restricted Bands of Operation from FCC Part 15, § 15.205

Test Procedure:

The EUT was first setup to transmit on both Channels 1 and 11 inside a semi-anechoic chamber. Measurements were performed with the EUT's antenna and the measurement antenna aligned for maximum emissions.

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 10th 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 25 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.

Peak measurements, which exceeded the average limit line were remeasured using video averaging and plotted against an average limit line.

Test Results:

The EUT was compliant with the requirements of this section.

Test Engineer(s):

Len Knight

Test Date(s):

11/06/07



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.209 Radiated Emissions – Spurious

Antenna	Frequency (GHz)	Average Measurement (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
2 dBi	2.841	45.82	54	8.18
9 dBi	7.384	39.6	54	14.4
12 dBi	7.384	48.12	54	5.88
7 dBi	7.385	39.76	54	14.24
2 dBi	7.385	46.26	54	7.74

Table 10. Spurious Radiated Emissions, Average Test Results

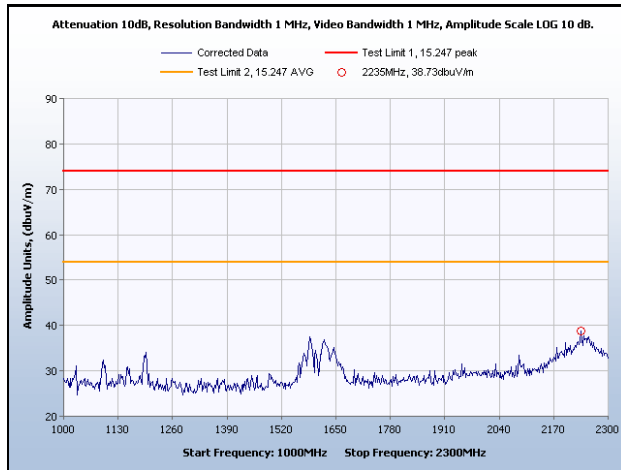
Antenna	Frequency (GHz)	Peak Measurement (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)
9 dBi	2.276	53.45	74	20.55
12 dBi	2.087	49.29	74	24.71
7 dBi	2.087	44.82	74	29.18
9 dBi	2.693	65.51	74	8.49
2 dBi	2.842	66.1	74	7.9
7 dBi	4.176	38.59	74	35.41
9 dBi	4.071	48.89	74	25.11
2 dBi	4.071	49.89	74	24.11
9 dBi	7.398	51.7	74	22.3
12 dBi	7.398	57.72	74	16.28
2 dBi	7.398	55.72	74	18.28

Table 11. Spurious Radiated Emissions, Peak Test Results

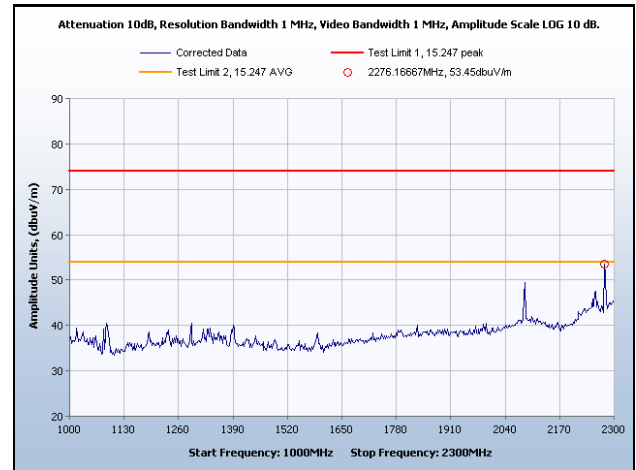


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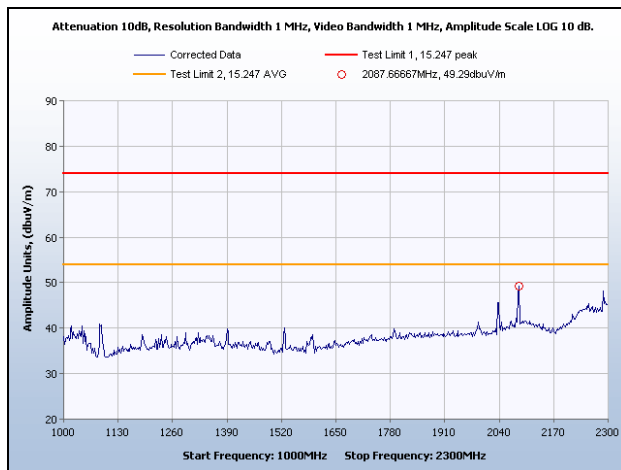
Electromagnetic Compatibility Criteria for Intentional Radiators CFR Title 47, Part 15, Subpart C



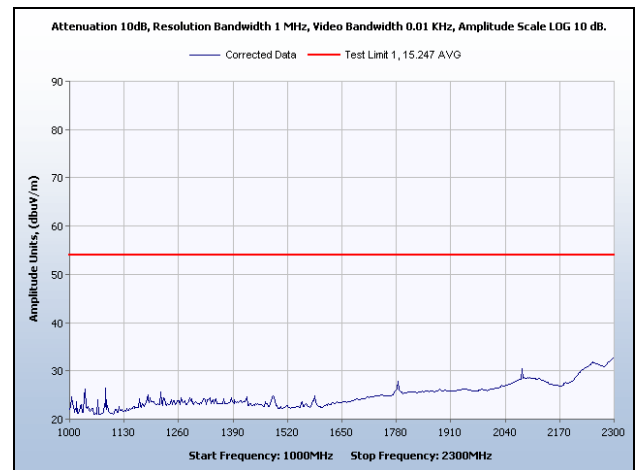
Spurious Radiated Emissions, 1-2.3 GHz 7 dBi, Mag. Antenna



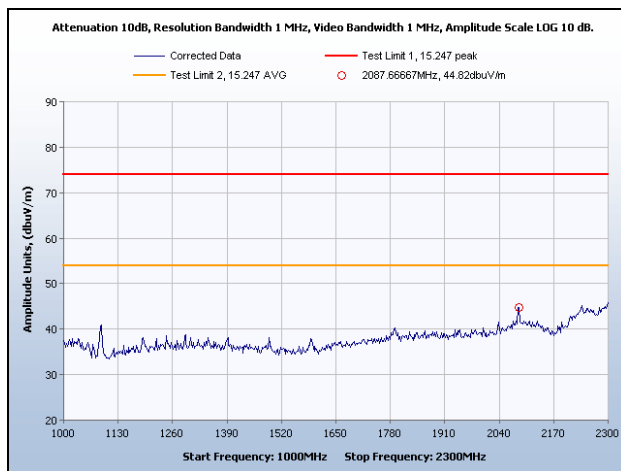
Spurious Radiated Emissions, 1-2.3 GHz 9 dBi, Sector Antenna



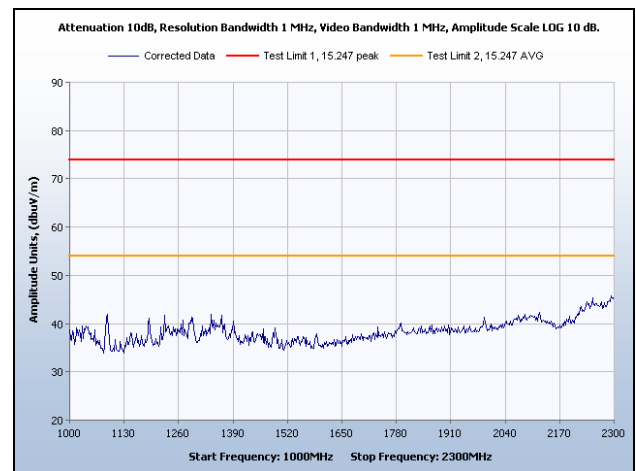
Spurious Radiated Emissions, 1-2.3 GHz 12 dBi, Omni Antenna



Spurious Radiated Emissions, 1-2.3GHz Avg. 9 dBi Sector Antenna



Spurious Radiated Emissions, 1-2.3 GHz, Cupcake Antenna

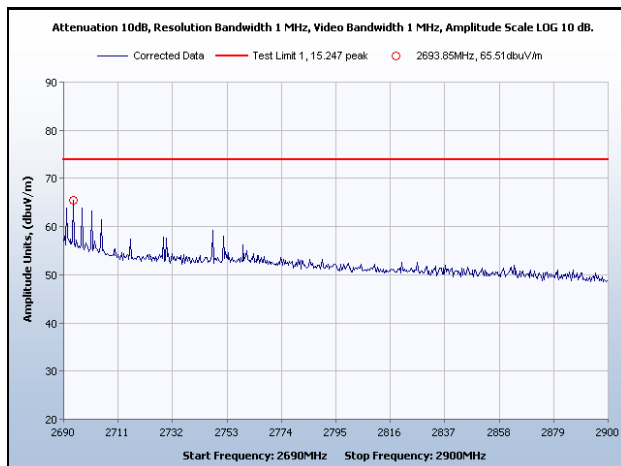


Spurious Radiated Emissions, 1-2.3 GHz, Internal Antenna

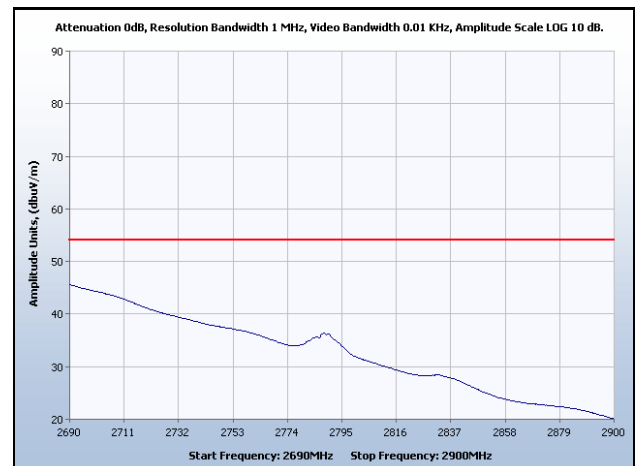


Rajant Corporation
Breadcrumb SE

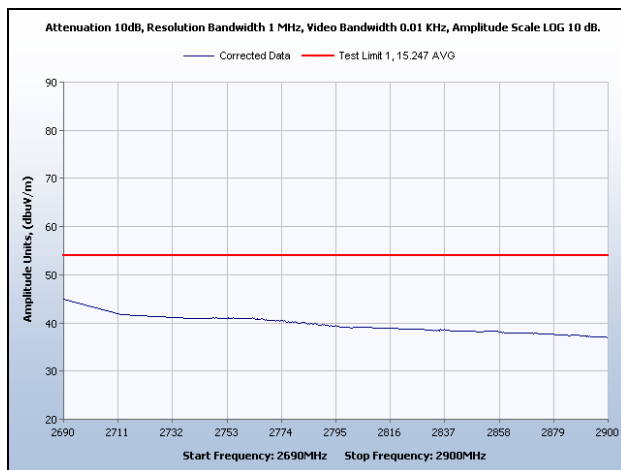
Electromagnetic Compatibility
Criteria for Intentional Radiators
CFR Title 47, Part 15, Subpart C



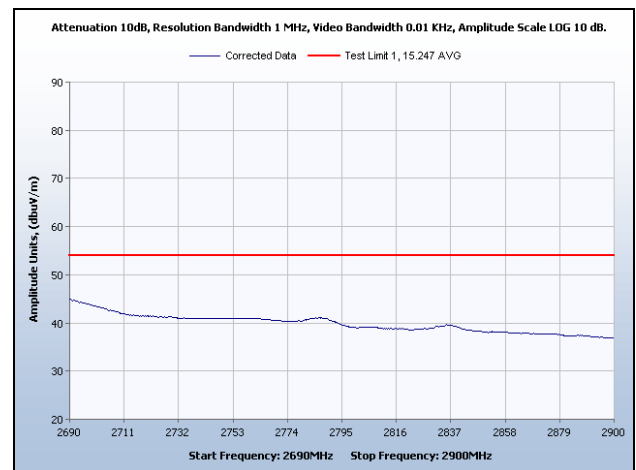
Spurious Radiated Emissions, 2.690-2.9 GHz, 9 dBi Sector Antenna



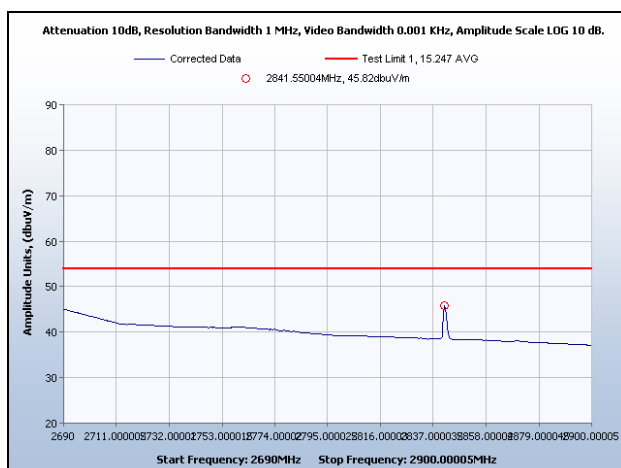
Spurious Radiated Emissions, 2.690-2.9 GHz, Avg. 7 dBi Mag. Antenna



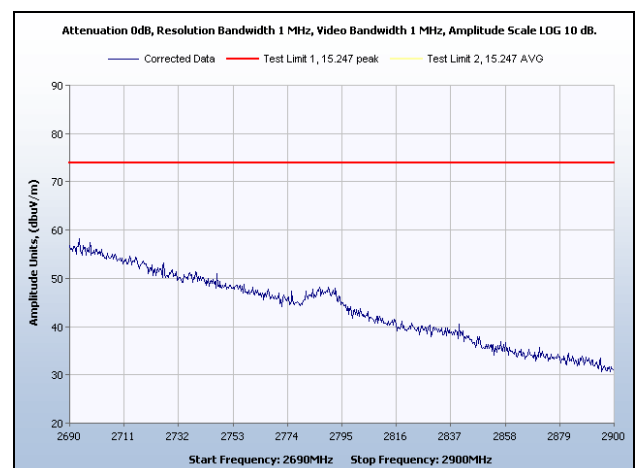
Spurious Radiated Emissions, 2.690-2.9 GHz, Avg. 9 dBi Sector Antenna



Spurious Radiated Emissions, 2.690-2.9 GHz, Avg. Cupcake Antenna



Spurious Radiated Emissions, 2.690-2.9 GHz, Avg. Internal Antenna

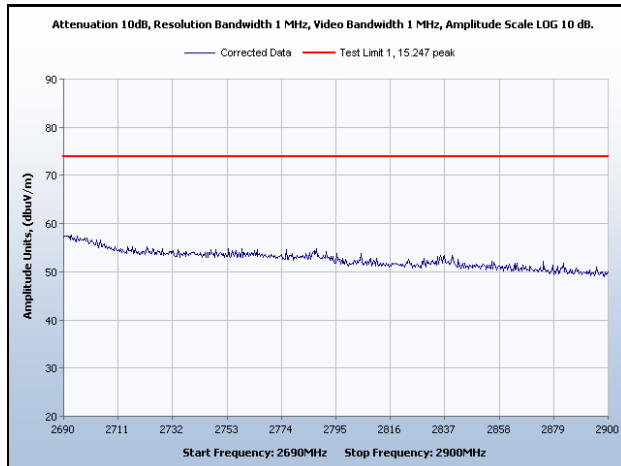


Spurious Radiated Emissions, 2.690-2.9 GHz, Peak 7 dBi Mag. Antenna

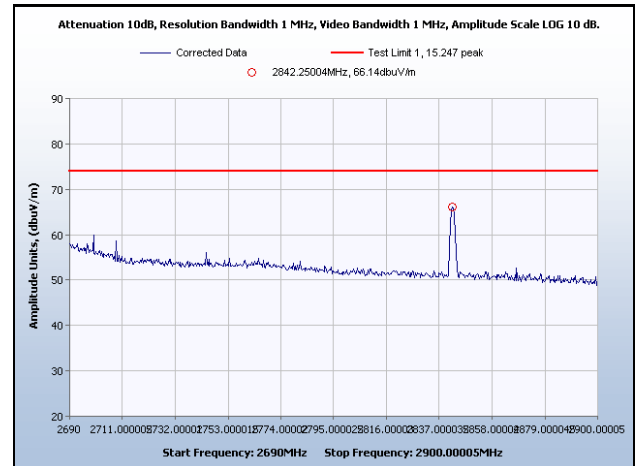


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Breadcrumb SE

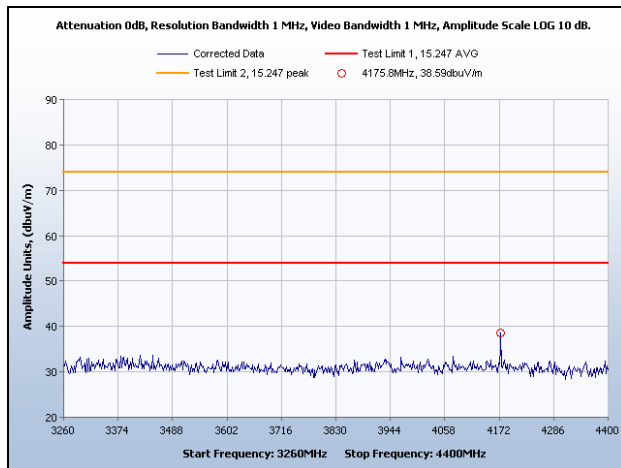
Electromagnetic Compatibility Criteria for Intentional Radiators CFR Title 47, Part 15, Subpart C



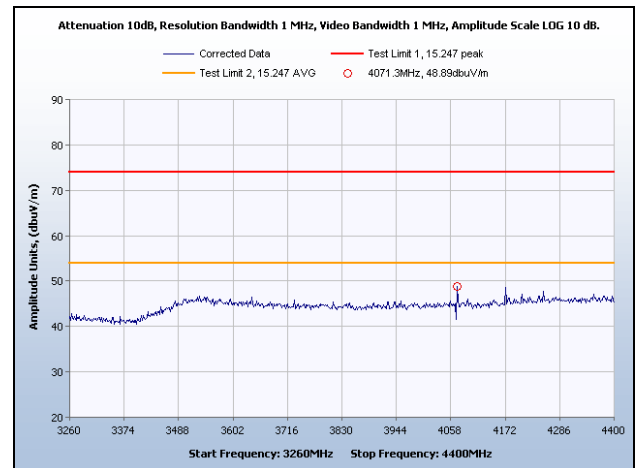
Spurious Radiated Emissions, 2.690-2.9 GHz, Peak Cupcake Antenna



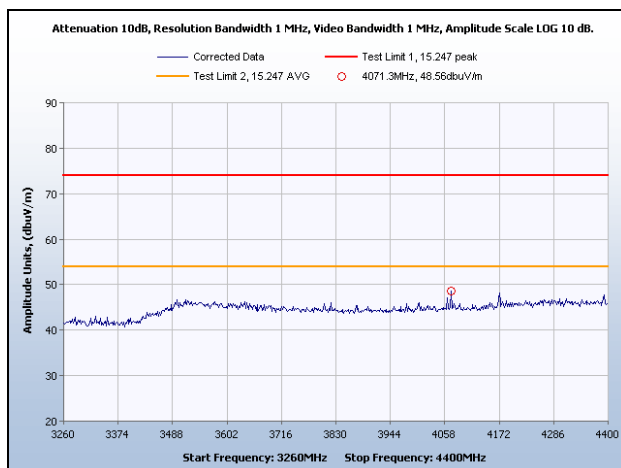
Spurious Radiated Emissions, 2.690-2.9 GHz, Peak Internal Antenna



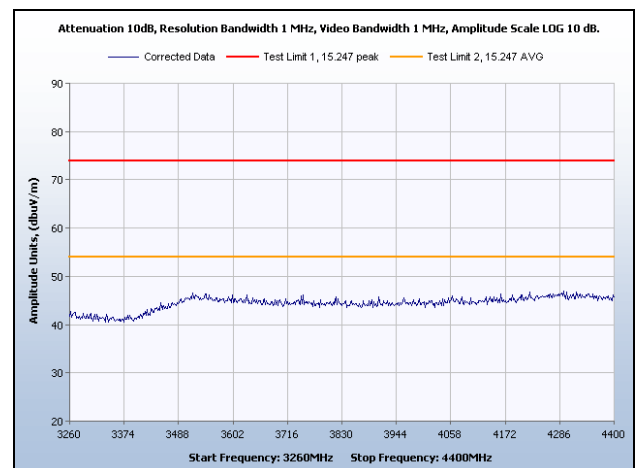
Spurious Radiated Emissions, 3.260-4.4 GHz, 7 dBi Mag. Antenna



Spurious Radiated Emissions, 3.260-4.4 GHz, 9 dBi Sector Antenna



Spurious Radiated Emissions, 3.260-4.4 GHz, 12 dBi Omni Antenna

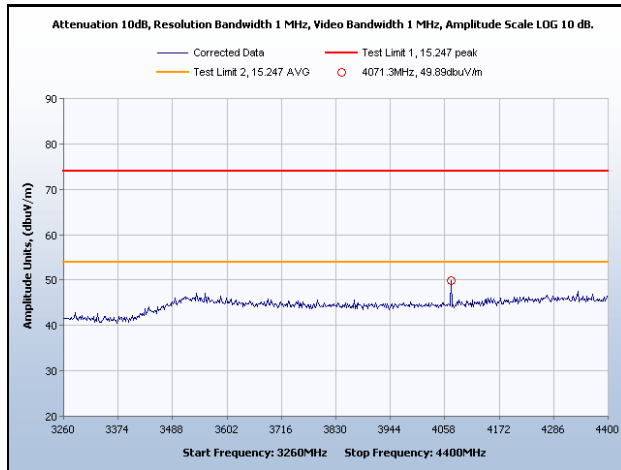


Spurious Radiated Emissions, 3.260-4.4 GHz, Cupcake Antenna

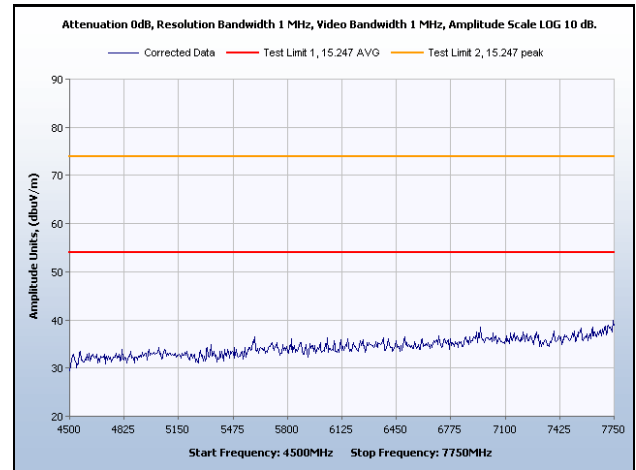


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Breadcrumb SE

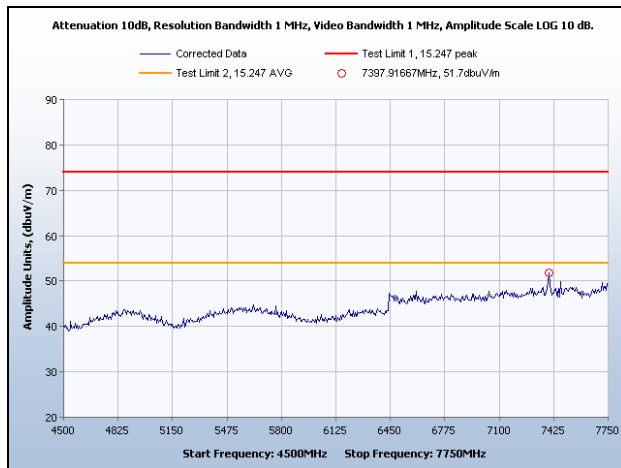
Electromagnetic Compatibility Criteria for Intentional Radiators CFR Title 47, Part 15, Subpart C



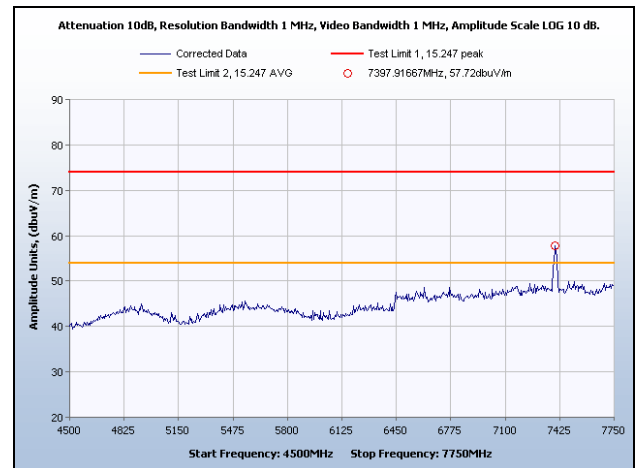
Spurious Radiated Emissions, 3.260-4.4 GHz, Internal Antenna



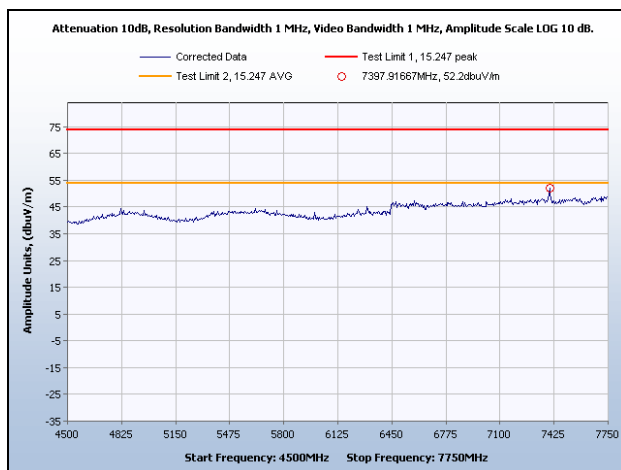
Spurious Radiated Emissions, 4.5-7.75 GHz, 7 dBi Mag. Antenna



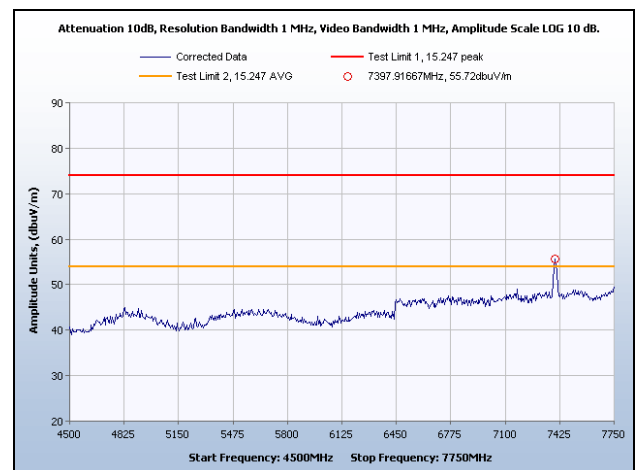
Spurious Radiated Emissions, 4.5-7.75 GHz, 9 dBi Sector Antenna



Spurious Radiated Emissions, 4.5-7.75 GHz, 12 dBi Omni Antenna



Spurious Radiated Emissions, 4.5-7.75 GHz, Cupcake Antenna

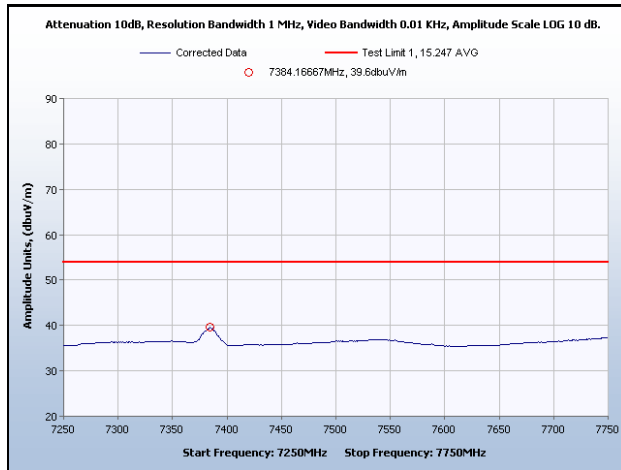


Spurious Radiated Emissions, 4.5-7.75 GHz, Internal Antenna

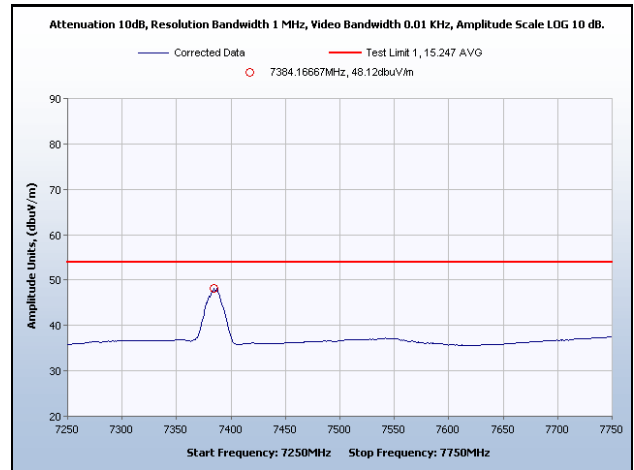


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Breadcrumb SE

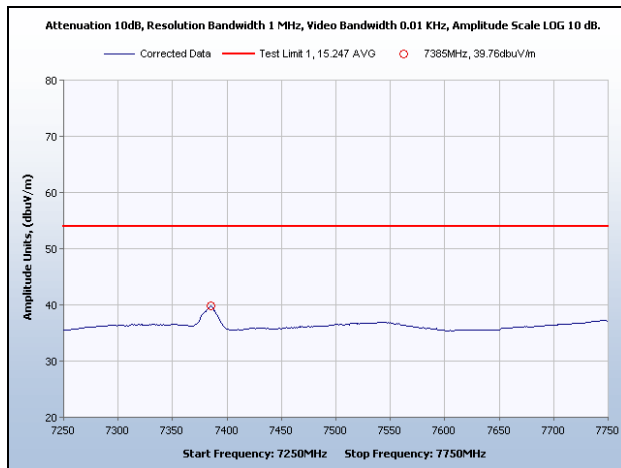
Electromagnetic Compatibility Criteria for Intentional Radiators CFR Title 47, Part 15, Subpart C



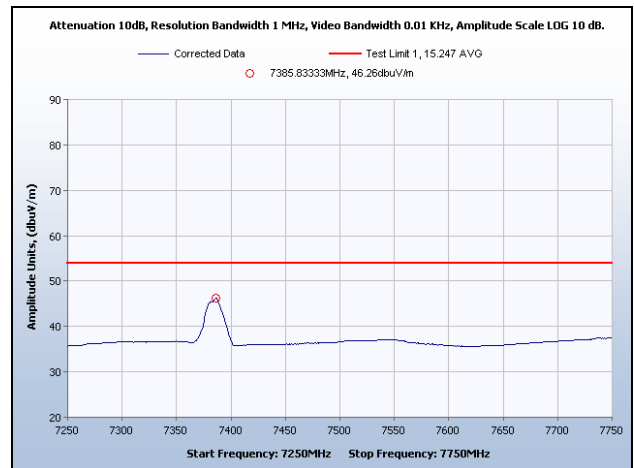
Spurious Radiated Emissions, 7.25-7.75 GHz, Avg. 9 dBi Sector Antenna



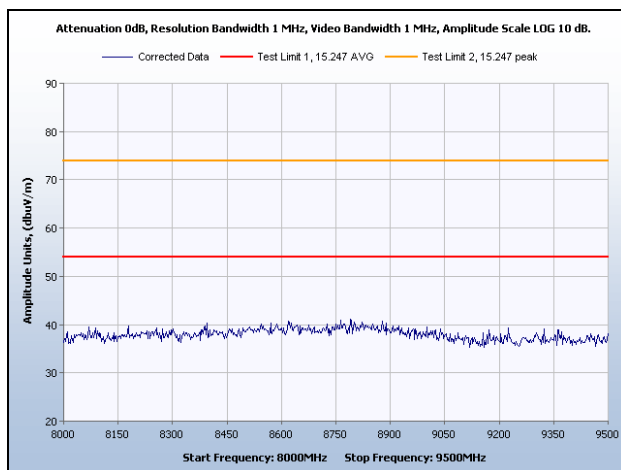
Spurious Radiated Emissions, 7.25-7.75 GHz, Avg. 12 dBi Omni Antenna



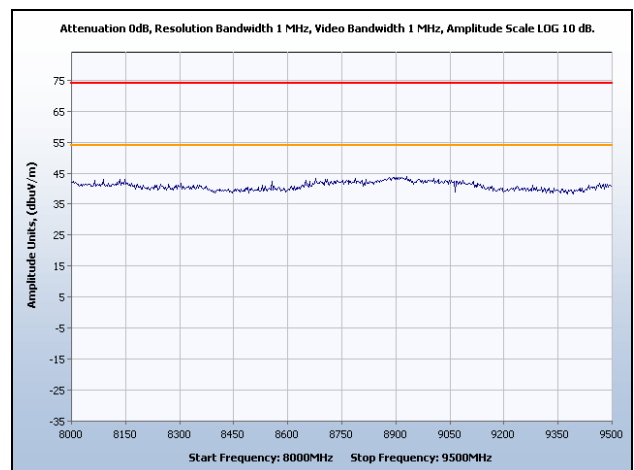
Spurious Radiated Emissions, 7.25-7.75 GHz, Avg. Cupcake Antenna



Spurious Radiated Emissions, 7.25-7.75 GHz, Avg. Internal Antenna



Spurious Radiated Emissions, 8-9.5 GHz, 7 dBi Mag. Antenna

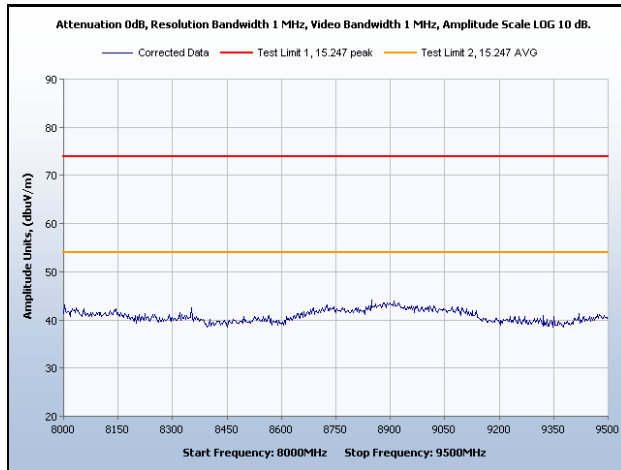


Spurious Radiated Emissions, 8-9.5 GHz, 9 dBi Sector Antenna

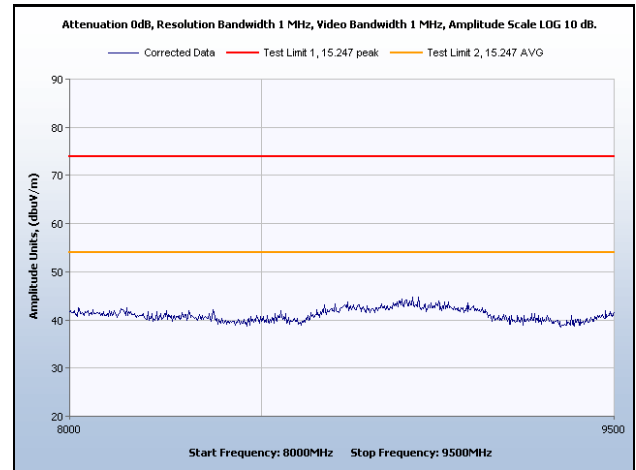


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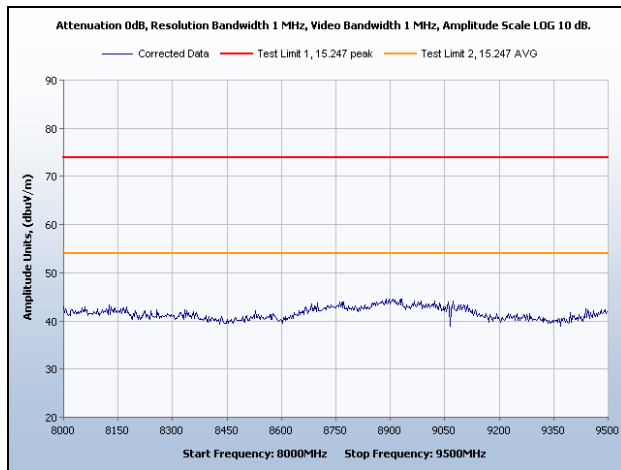
Electromagnetic Compatibility Criteria for Intentional Radiators CFR Title 47, Part 15, Subpart C



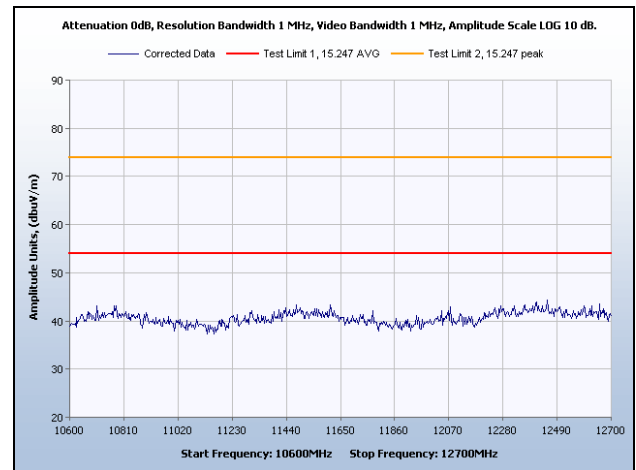
Spurious Radiated Emissions, 8-9.5 GHz, 12 dBi Omni Antenna



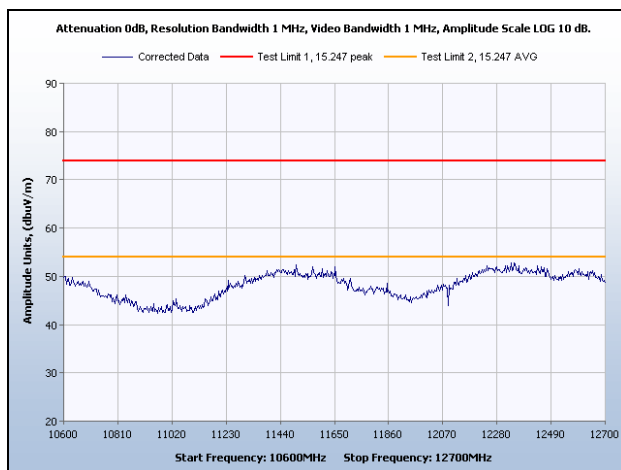
Spurious Radiated Emissions, 8-9.5 GHz, Cupcake Antenna



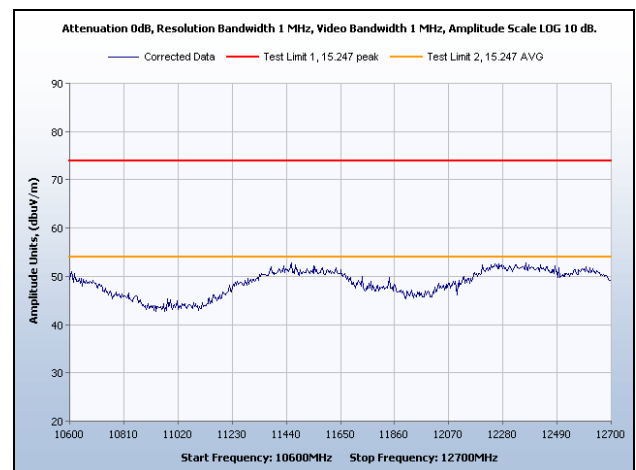
Spurious Radiated Emissions, 8-9.5 GHz, Internal Antenna



Spurious Radiated Emissions, 10.6-12.7 GHz, 7 dBi Mag. Antenna



Spurious Radiated Emissions, 10.6-12.7 GHz, 9 dBi Sector Antenna

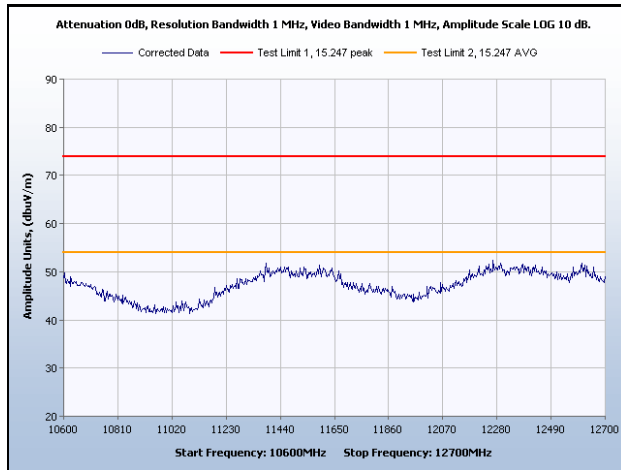


Spurious Radiated Emissions, 10.6-12.7 GHz, 12 dBi Omni Antenna

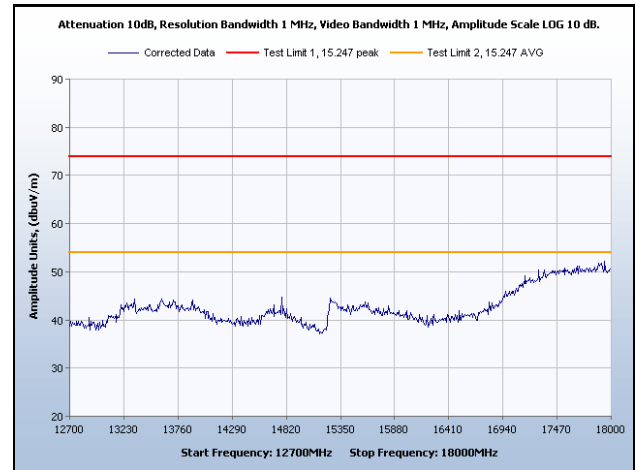


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Breadcrumb SE

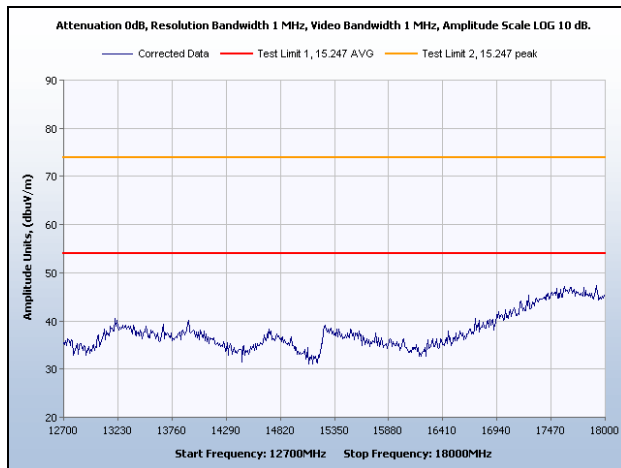
Electromagnetic Compatibility
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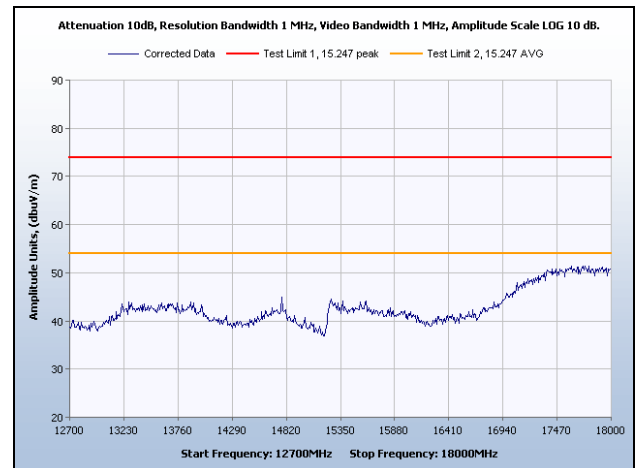
Spurious Radiated Emissions, 10.6-12.7 GHz, Cupcake Antenna



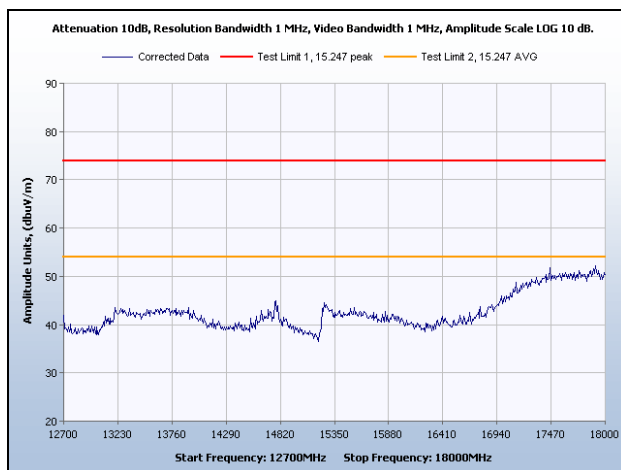
Spurious Radiated Emissions, 10.6-12.7 GHz, Internal Antenna



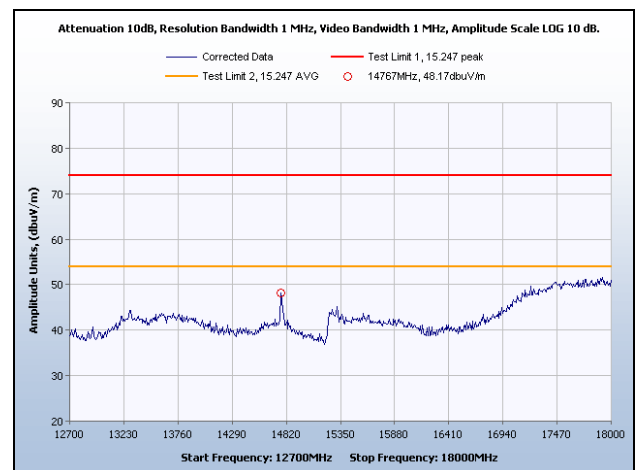
Spurious Radiated Emissions, 12.7-18 GHz, 7 dBi Mag. Antenna



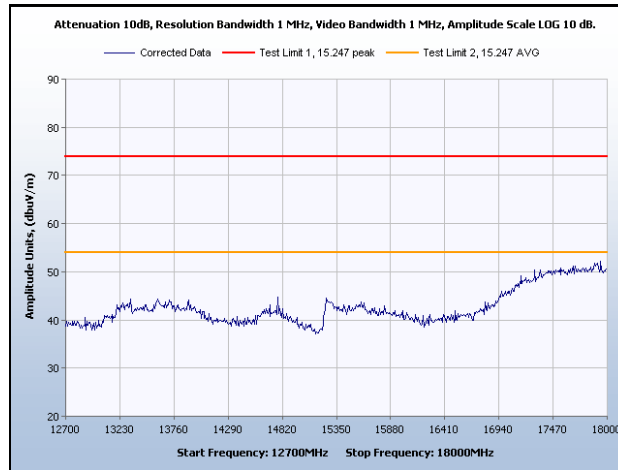
Spurious Radiated Emissions, 12.7-18 GHz, 9 dBi Sector Antenna



Spurious Radiated Emissions, 12.7-18 GHz, 12 dBi Omni Antenna



Spurious Radiated Emissions, 12.7-18 GHz, Cupcake Antenna



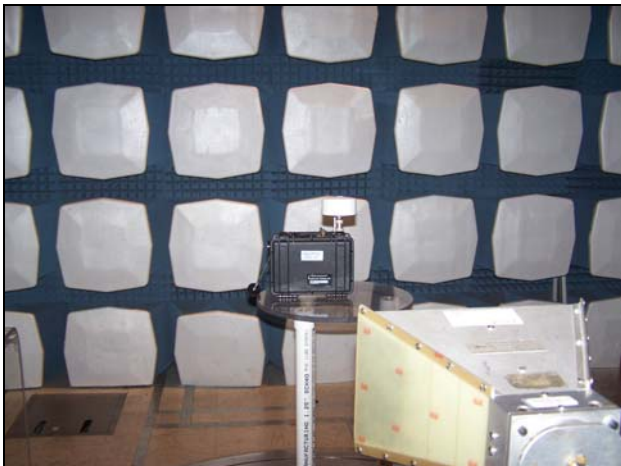
Spurious Radiated Emissions, 12.7-18 GHz, Internal Antenna



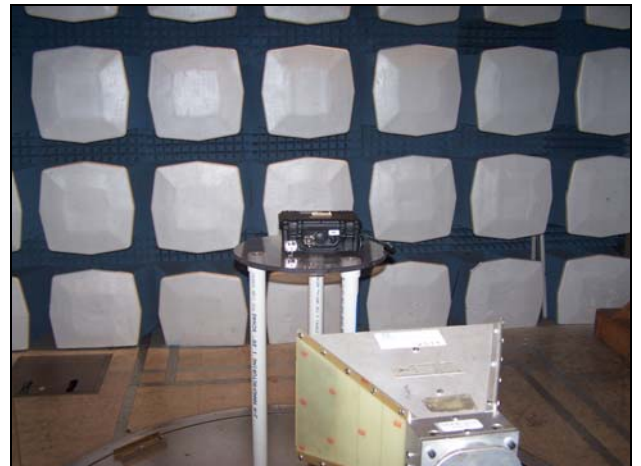
Photograph 2. Spurious Radiated Emissions Test Setup, 9 dBi Sector



Photograph 3. Spurious Radiated Emissions Test Setup, 12 dBi Omni



Photograph 4. Spurious Radiated Emissions, Test Setup, Cupcake Antenna



Photograph 5. Spurious Radiated Emissions, Test Setup, Internal Antenna



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(a) 6 dB a Bandwidth

Test Requirements:	<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>
Test Procedure:	<p>The EUT has two separate transmitters. One operates only on Channel 1 and the other only on Channel 11. The transmitters were set 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 > RBW. The 6 dB Bandwidth was measured and recorded.</p>
Test Results:	<p>Equipment complies with § 15.247 (a). The 6 dB Bandwidth was determined from the plots on the following pages.</p>
Test Engineer(s):	<p>Len Knight</p>
Test Date(s):	<p>11/05/07</p>

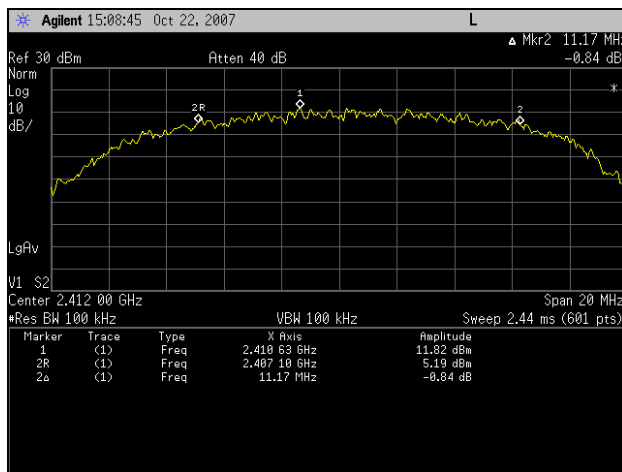


Electromagnetic Compatibility Criteria for Intentional Radiators

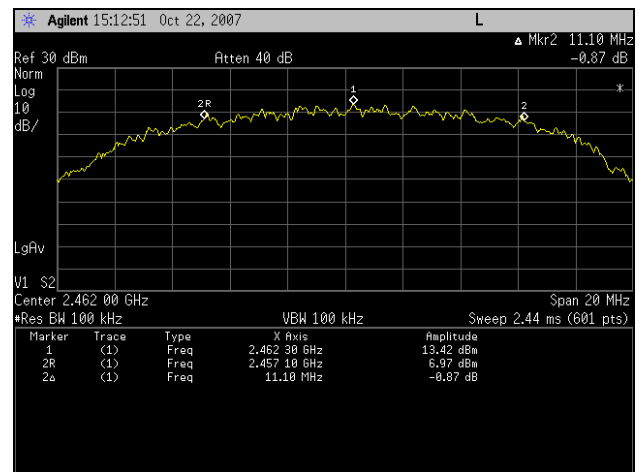
§ 15.247(a) 6 dB Bandwidth

Channel	Measured 6 dB Bandwidth	Test Limit (kHz)
Channel 1	11.17 MHz	≥ 500
Channel 11	11.10 MHz	≥ 500

Table 12. 6 dB Bandwidth Test Results



6 dB Bandwidth, Channel 1



6 dB Bandwidth, Channel 11



Photograph 6. 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 13. 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 13, 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: The EUT has two separate transmitters. One operates only on Channel 1 and the other only on Channel 11. The transmitters were set at maximum output power and connected to a calibrated PSA Spectrum Analyzer. The EUT was measured at each channel.

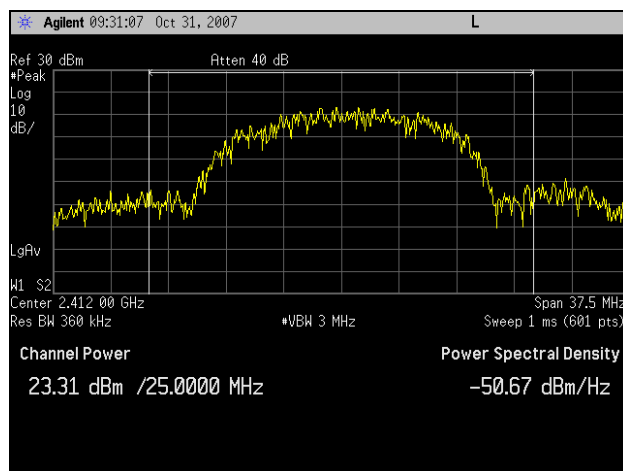
Test Results: Equipment complies with the Peak Power Output limits of § 15.247(b).

Channel #	Measured Output Power (dBm)
Channel 1	23.31
Channel 11	25.1

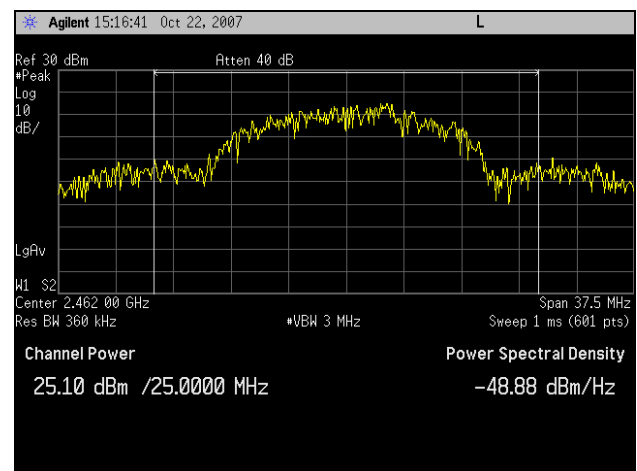
Table 14. Peak Output Power

Test Engineer(s): Len Knight

Test Date(s): 11/05/07



Peak Output Power, Channel 1



Peak Output Power, Channel 11

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(b) Peak Power Output



Photograph 7. 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 ²)	Average Time (minutes)
(A) Limits for Occupational/Control Exposures				
30-300	61.4	0.163	1.0	6
300-1,500	--	--	F/300	6
1,500-100,000	--	--	5	6
(B) Limits for General Population/Uncontrolled Exposure				
30-300	27.5	0.073	0.2	30
300-1,500	--	--	F/1,500	30
1,500-100,000	--	--	1.0	30

Table 15. 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/m²

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: MPE Limit Calculation: EUT's operating frequencies @ 2412 and 2462 MHz; only channel 1 and 11 are active on this unit. There are two transmitter modules and each one has its own antenna.. Channel 11 is always connected to an internal 2 dBi antenna. Channel 1 can be connected to an internal 2 dBi antenna or an external antenna of higher gain. Highest conducted power on channel 1 = 23.31 dBm (peak) and highest conducted power on channel 11 = 25.1 dBm. The following antennas can be used with Channel 1:

- 2 dBi Omni directional antenna (internal)
- 3 dBi Omni directional Cupcake antenna
- 7 dBi Omni directional Mag antenna
- 9 dBi 120 degree sector antenna
- 12 dBi Omni directional antenna

The MPE calculation for Channel 1 will be done with the highest gain antenna; 12 dBi.

Limit for Uncontrolled exposure: 1 mW/cm².

EUT maximum antenna gain = 12 dBi.

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

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

where, S = Power Density mW/m²
P = Power Input to antenna mili Watts
G = Numeric Antenna Gain
R = Distance to the center of radiation of the antenna (20 cm for Mobile minimum distance)

Channel 1:

Antenna Numeric Gain = 10^{12/10} dBi

Power at antenna port = 214.3 mW

Antenna Gain = 12 dBi

Numeric antenna gain = 10^{12/10} = 15.85

$$S = (214.3)(15.85) / 4(3.1416)(20)^2$$

$$S = 0.676 \text{ mW/cm}^2$$

The MPE calculation for Channel 11 will be done with the 2 dBi internal antenna

Channel 11:

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

Power at antenna port = 323.6 mW

Antenna Gain = 2 dBi

Numeric antenna gain = $10^{2/10} = 1.58$

$$S = (323.6)(1.58) / 4(3.1416)(20)^2$$

$$S = 0.102 \text{ mW/cm}^2$$

In the worst case condition where the power is additive:

$$S = 0.676 \text{ mW/cm}^2 + S = 0.102 \text{ mW/cm}^2$$

$$S_{\text{total}} = 0.778 \text{ mW/cm}^2$$

Less than the 1 mW/cm^2 Limit for Uncontrolled exposure

Therefore, the EUT meets the Uncontrolled Exposure Limit.

Therefore, the EUT meets the Uncontrolled Exposure limit.

Test Engineer(s): Len Knight

Test Date(s): 11/06/07



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Spurious Emissions – RF Conducted

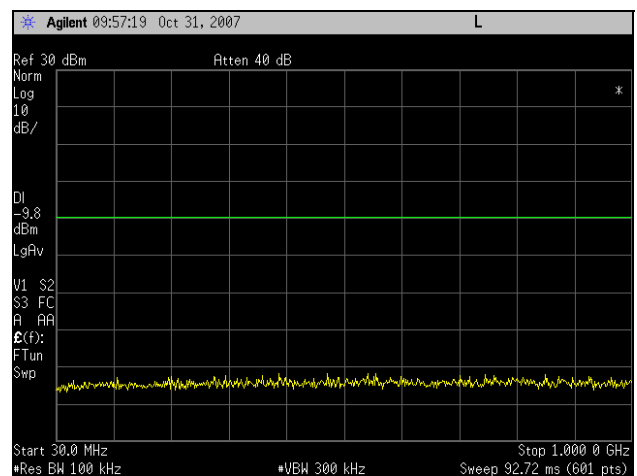
Test Requirements: §15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth 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).

Test Procedure: The EUT has two separate transmitters. One operates only on Channel 1 and the other only on Channel 11. The transmitters were set 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 > RBW. The 6 dB Bandwidth was measured and recorded.

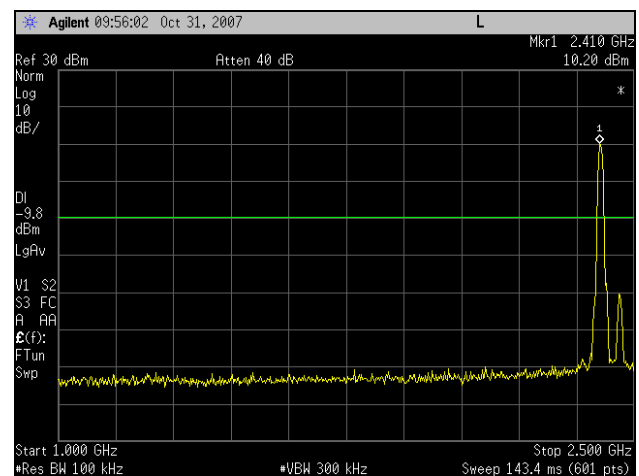
Test Results: The EUT was compliant with the requirements of this section.

Test Engineer(s): Len Knight

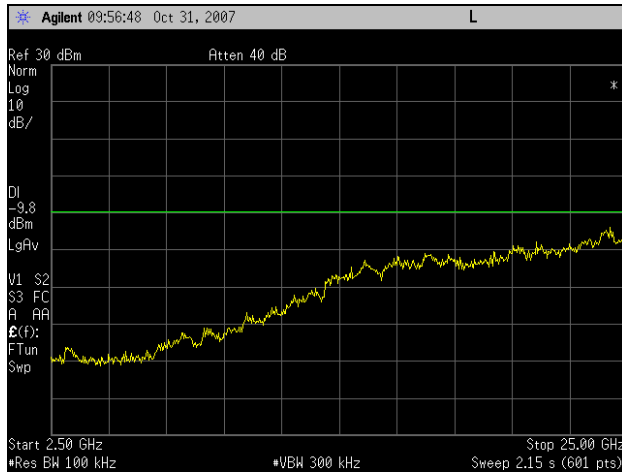
Test Date(s): 10/22/07



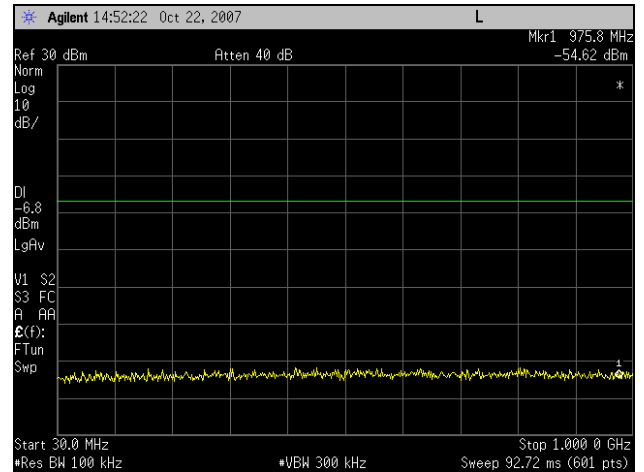
Spurious RF Conducted Emissions, Channel 1, 30MHz – 1GHz



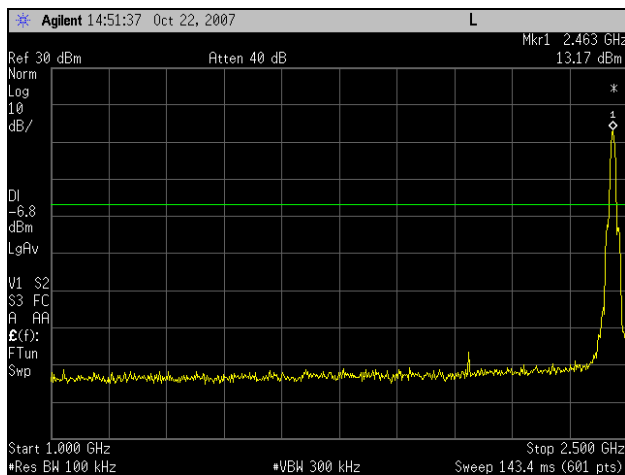
Spurious RF Conducted Emissions, Channel 1, 1GHz – 2.5GHz



Spurious RF Conducted Emissions, Channel 1, 2.5GHz – 25GHz



Spurious RF Conducted Emissions, Channel 11, 30MHz – 1GHz



Spurious RF Conducted Emissions, Channel 11, 1GHz – 2.5GHz



Spurious RF Conducted Emissions, Channel 11, 2.5GHz – 26GHz



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

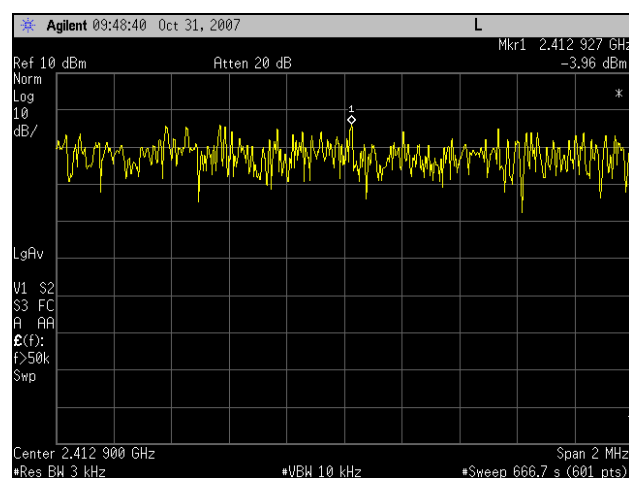
Test Results: Equipment complies with the peak power spectral density limits of § 15.247 (e). The peak power spectral density was determined from plots on the following page(s).

Test Engineer(s): Len Knight

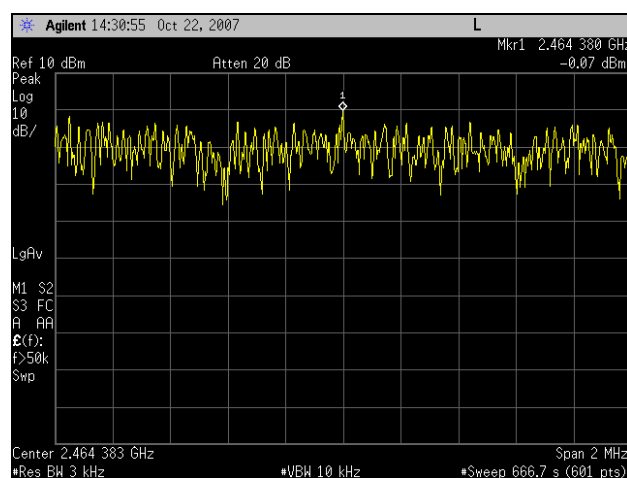
Test Date(s): 11/05/07

Channel	Measured PPSD (dBm)	Test Limit (dBm)
Channel 1	-3.96	8
Channel 11	-0.07	8

Table 16. Peak Power Spectral Density Test Results



Peak Power Spectral Density, Channel 1



Peak Power Spectral Density, Channel 11



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IV. Test Equipment



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CFR Title 47, Part 15, Subpart C

Test Equipment

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

Test Name: Conducted Emissions					
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4502	COMB GENERATOR	COM-POWER	CGC-255	08/30/2007	08/30/2008
1T4503	SHIELDED ROOM	UNIVERSAL SHIELDING CORP	N/A	06/01/2006	06/01/2007
1T4079	LISN; SWITCH	SOLAR	8012-50-R-24-BNC	04/02/2007	04/02/2008
1T4563	LISN (10 AMP)	SOLAR ELECTRONICS	9322-50-R-10-BNC	08/30/2006	08/30/2007
1T4351	SPECTRUM ANALYZER	AGILENT	E7405A	10/13/2006	10/13/2007
Test Name: Radiated Emissions					
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4300	SEMI-ANECHOIC CHAMBER #1	EMC TEST SYSTEMS	NONE	02/17/2006	01/17/2009
1T4409	EMI RECEIVER	ROHDE & SCHWARTZ	ESIB7	04/24/2007	04/24/2008
1T4303	ANTENNA; BILOG	SCHAFNER – CHASE EMC	CBL6140A	06/29/2007	06/29/2008
Test Name: 6 dB Bandwidth					
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4503	SHIELDED ROOM	UNIVERSAL SHIELDING CORP	N/A	06/01/2006	06/01/2007
RENTAL	PSA SPECTRUM ANALYZER	AGILENT	E448A	02/20/2007	02/20/2008
Test Name: Peak Power Output					
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4503	SHIELDED ROOM	UNIVERSAL SHIELDING CORP	N/A	06/01/2006	06/01/2007
RENTAL	PSA SPECTRUM ANALYZER	AGILENT	E448A	02/20/2007	02/20/2008
Test Name: Spurious Emissions					
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4503	SHIELDED ROOM	UNIVERSAL SHIELDING CORP	N/A	06/01/2006	06/01/2007
RENTAL	PSA SPECTRUM ANALYZER	AGILENT	E448A	02/20/2007	02/20/2008
1T2665	ANTENNA; HORN	EMCO	3115	04/17/2007	04/17/2008
1T2511	ANTENNA; HORN	EMCO	3115	07/19/2007	07/19/2008
1T4080	SPECTRUM ANALYZER W/ MEMORY MODULE	HEWLETT PACKARD	8563A	09/11/2006	09/11/2007
Test Name: Peak Power Spectral Density					
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4503	SHIELDED ROOM	UNIVERSAL SHIELDING CORP	N/A	06/01/2006	06/01/2007
RENTAL	PSA SPECTRUM ANALYZER	AGILENT	E448A	02/20/2007	02/20/2008

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



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Electromagnetic Compatibility
Certification & User's Manual Information
CFR Title 47, Part 15, Subpart C

V. Certification & User's Manual Information



Certification & User's Manual Information

5.1 Certification Information

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

§ 2.801 Radio-frequency device defined.

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

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

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

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



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



Certification & User's Manual Information

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

§ 2.901 Basis and Purpose

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

§ 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.

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



Certification & User's Manual Information

§ 2.948 Description of measurement facilities.

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



Certification & User's Manual Information

5.2 Label and User's Manual Information

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

§ 15.19 Labeling requirements.

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

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

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

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

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

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

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

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

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

§ 15.21 Information to user.

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



Verification & User's Manual Information

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

§ 15.105 Information to the user.

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

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a 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.