MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
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33439 WESTERN AVENUE ● UNION CITY, CALIFORNIA 94587 ● PHONE (510) 489-6300 ● FAX (510) 489-6372
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April 15, 2010

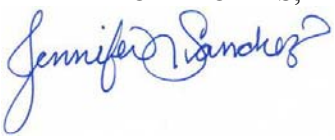
Rajant Corporation
400 E. King Street
Malvern, PA 19355

Dear Keith Sullivan,

Enclosed is the EMC Wireless test report for compliance testing of the Rajant Corporation, LX3-2495 as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 15, Subpart B, ICES-003, Issue 4 February 2004 for a Class A Digital Device and FCC Part 15 Subpart C, RSS-210, Issue 7, June 2007 for Intentional Radiators

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

Sincerely yours,
MET LABORATORIES, INC.



Jennifer Sanchez
Documentation Department

Reference: (\Rajant Corporation\EMC26779A-FCC247)

Electromagnetic Compatibility Criteria
Test Report

for the

Rajant Corporation
Model LX3-2495

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

MET Report: EMC26779A-FCC247

April 15, 2010

Prepared For:

Rajant Corporation
400 E. King Street
Malvern, PA 19355

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

Electromagnetic Compatibility Criteria
Test Report

for the

Rajant Corporation
Model LX3-2495

Tested Under

Title 47 of the CFR, Parts 15 Subpart B & ICES-003
for Class A Digital Devices
&
15.247 Subpart C & RSS-210, Issue 7, June 2007
for Intentional Radiators

Dusmantha Tennakoon, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Sanchez
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of FCC Rules Parts 15B, 15.247 and Industry Canada standards ICES-003, Issue 4 February 2004, RSS-210, Issue 7, June 2007 under normal use and maintenance.

Shawn McMillen, Wireless Manager
Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	April 15, 2010	Initial Issue.

Table of Contents

List of Tables

List of Plots

List of Figures

List of Terms and Abbreviations

AC	**A**lternating **C**urrent
ACF	**A**ntenna **C**orrection **F**actor
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci**b**els
dBµA	**D**eci**b**els above one **micro**amp
dBµV	**D**eci**b**els above one **micro**volt
dBµA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBµV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**er**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**er**z**
kPa	**k**ilo**pa**scal
kV	**k**ilovolt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µH	**micro**henry
µ	**micro**farad
µs	**micro**seconds
NEBS	**N**etwork **E**quipment-**B**uilding **S**ystem
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
TWT	**T**raveling **W**ave **T**ube
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane

I. Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Rajant Corporation LX3-2495, 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 LX3-2495. 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 LX3-2495, 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 Rajant Corporation, purchase order number 2009101. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference	IC Reference	Description	Compliance
47 CFR Part 15.247:2005	RSS-210 Issue 7: 2007	Applicable Standard	Compliant
Title 47 of the CFR, Part 15 §15.203	N/A	Antenna Requirement	Compliant
Title 47 of the CFR, Part 15 §15.205	RSS-210(A8.5)	Emissions at Restricted Band	Compliant
Title 47 of the CFR, Part 15 §15.207(a)	RSS-210(7.2.2)	Conducted Emission Voltage	Compliant
Title 47 of the CFR, Part 15 §15.247(a)(1)	RSS-210(A8.1)	Occupied Bandwidth	Compliant
Title 47 of the CFR, Part 15 §15.247(b)	RSS-210(A8.4)	RF Output Power	Compliant
Title 47 of the CFR, Part 15 §15.247(c)	RSS-210(A8.4)	Antenna Gain >6dBi	Compliant
Title 47 of the CFR, Part 15 §15.209, §15.247(d)	RSS-210(A8.5)	Radiated and Conducted Spurious Emissions	Compliant
Title 47 of the CFR, Part 15; §15.247(e)	RSS-210(A8.3)	Power Spectral Density	Compliant
Title 47 of the CFR, Part 15 §15.247(i)	RSSGen(5.5)	Maximum Permissible Exposure	Compliant
N/A	RSSGen(4.8)	Receiver Spurious Emissions	Compliant

Table 1. Executive Summary of EMC Part 15.247 Compliance Testing

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Rajant Corporation to perform testing on the LX3-2495, under Rajant Corporation's purchase order number 2009101.

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, LX3-2495.

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

Model(s) Tested:	LX3-2495	
Model(s) Covered:	LX3-2495 (915MHz, 2.45GHz and 5.8GHz radio configuration)	
EUT Specifications:	Primary Power: 120V/60Hz	
	FCC ID: VJA-LX3-2495 IC: 7382A-LX3-2495	
	Type of Modulations:	DSSS (Direct Sequence Spread Spectrum) OFDM (Orthogonal Frequency Division multiplexing)
	Equipment Code:	DTS
	Peak RF Output Power:	900 MHz: 27.48 dBm
		2.4 GHz: 28.75 dBm
		5.8 GHz: 26.25 dBm
	EUT Frequency Ranges:	907-922MHz, 2412-2462MHz, 5745-5825MHz
Analysis:	The results obtained relate only to the item(s) tested.	
Evaluated by:	Dusmantha Tennakoon	
Report Date(s):	April 15, 2010	

Table 2. EUT Summary Table

Note: Highest receiver spurs were 45.93 dBuV/m @ 3m.

B. 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
RSS-210, Issue 7, June 2007	Low-power Licence-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment
CFR 47, Part 15, Subpart B	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
ICES-003, Issue 4 February 2004	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
ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices

Table 3. References

C. Test Site

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

Radiated Emissions measurements were performed in a semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

D. Description of Test Sample

The Rajant Corporation LX3-2495 are portable networking devices that support wired and wireless routing, and 802.11a/b/g access point/bridging/meshing functionality. They can be powered from external batteries or an external AC/DC power supply. The models look alike from the outside and the only difference inside the unit is the radio module configurations.

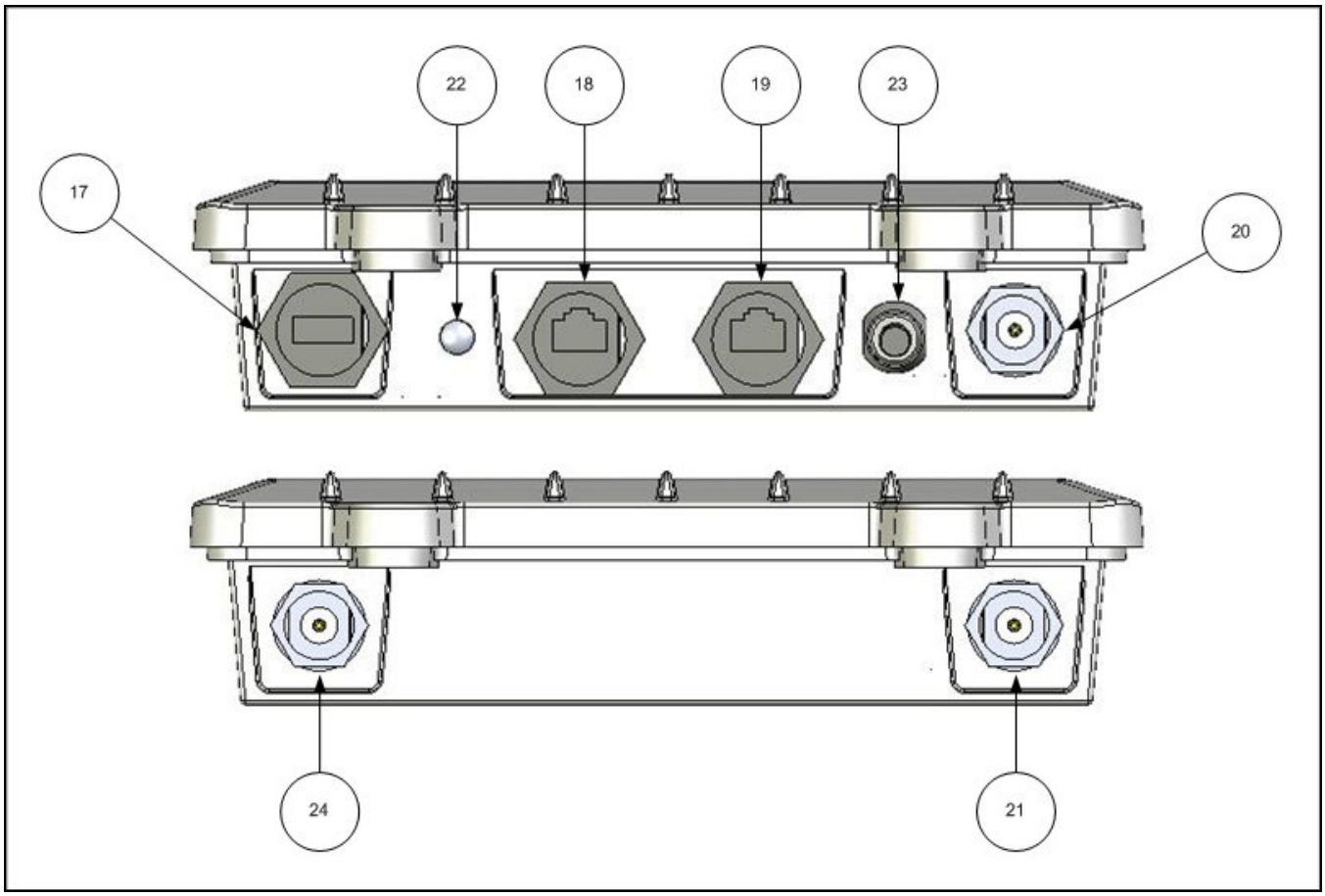


Figure 1. Block Diagram of Test Configuration (Ports)

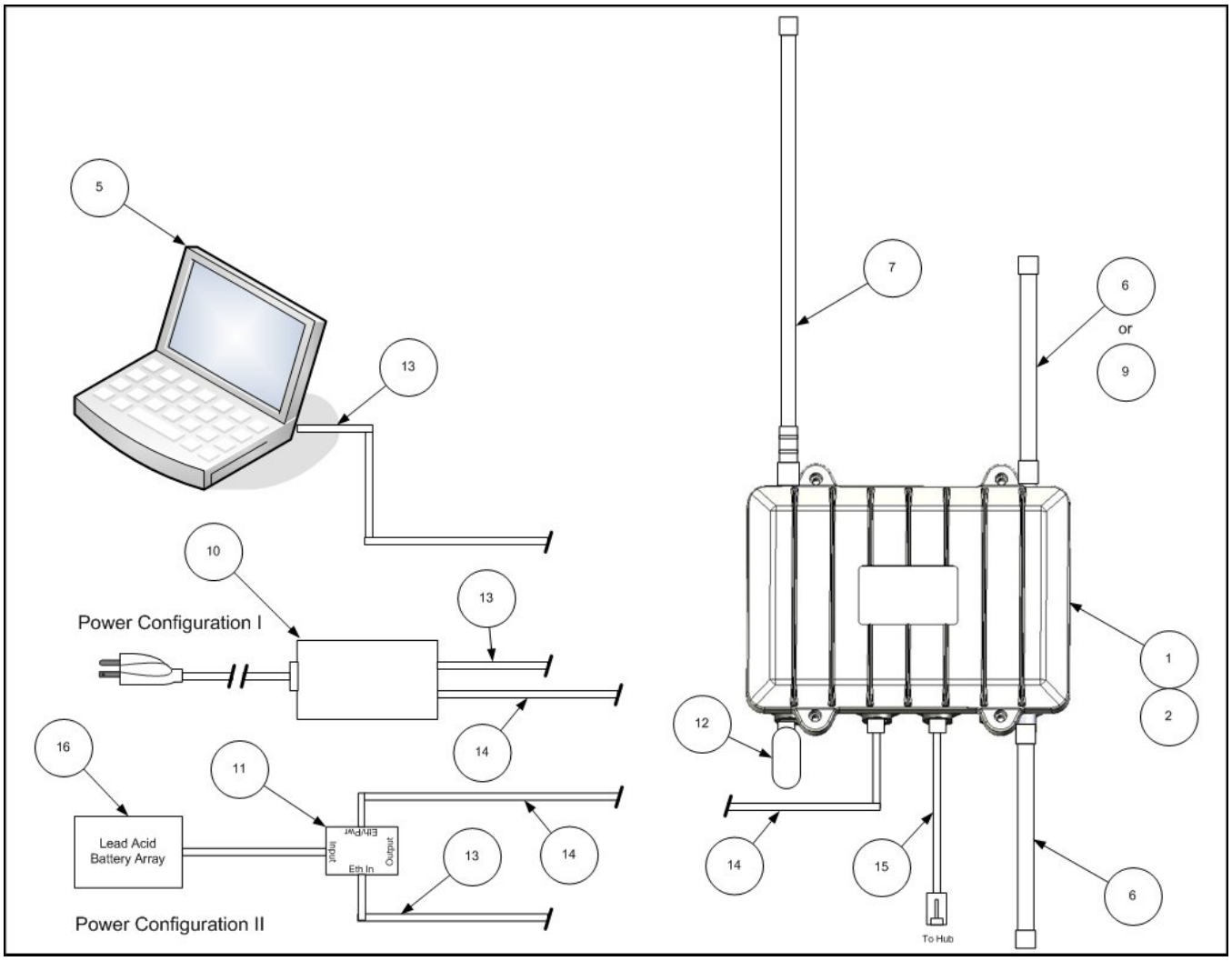


Figure 2. Block Diagram of Test Configuration (Cabling)

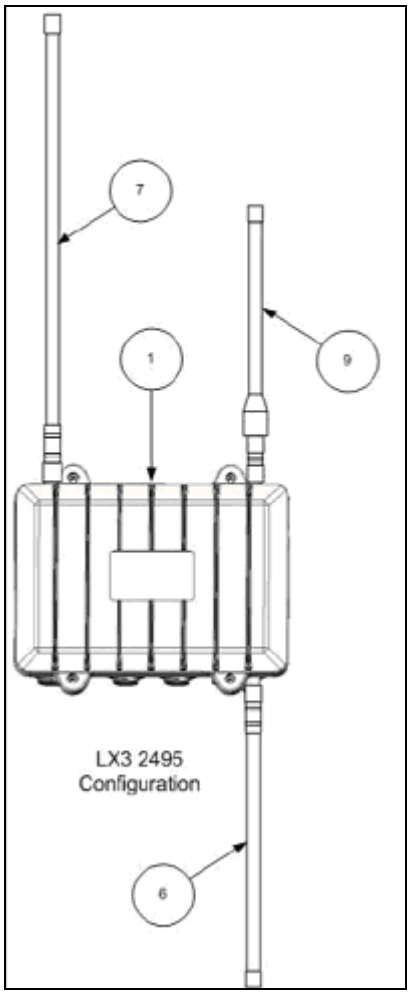


Figure 3. Block Diagram of Test Configuration (Antennas)

E. Equipment Configuration

All cards, racks, etc., incorporated as part of the EUT is included in the following list.

Ref. ID	Name / Description	Model Number	Serial Number
1	BreadCrumb LX3-2495	LX3-2495	LX3 2495-4061

Table 4. Equipment Configuration

F. Support Equipment

Rajant Corporation supplied support equipment necessary for the operation and testing of the LX3-2495. All support equipment supplied is listed in the following Support Equipment List.

Ref. ID	Name / Description	Manufacturer	Model Number
5	Laptop	IBM	Thinkpad
6	5dBi Omni Antenna, 2.4GHz, Type-N	Pacific Wireless	OD24M-5
7	5dBi Omni Antenna, 900MHz, Type-N	Pacific Wireless	ODN9-5
9	6dBi Omni Antenna, 5GHz, Type-N	Terrawave	T58060O10006
10	AC/DC Adapter 48Vdc PoE injector	Cincon	TR-60A
11	DC-DC Vehicular 24Vdc PoE Injector	Rajant Corp.	VHDC24
12	USB Memory Stick	n/a	n/a
13	Cat5 Ethernet Cable	n/a	n/a
14	Cat5 Shielded, Ethernet Cable, UV Stabilized	n/a	n/a
15	Cat5 Ethernet Cable	n/a	n/a
16	Lead Acid Battery	n/a	n/a

Table 5. Support Equipment

G. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty.	Length (m)	Shielded? (Y/N)	Termination Box ID & Port ID
17	USB Port	USB Token	1	N/a	N	Item 17 (USB connector)
18	Power and ETH0 Port	RJ45 Cat5 (Item 14)	1	n/a	N	Item 18 (Eth0 Port)
19	ETH1 Port	RJ45 Cat5 (Item 15)	1	n/a	N	Item 19 (Eth1 Port)
20	RF Port – Bottom (2.4Ghz)	5dBi 2.4Ghz omni antenna	1	n/a	N	Item 20 (Type-N RF conn.)
21	RF Port – Top	Various Frequency Antenna (Items 6,7)	1	n/a	N	Item 21 (Type-N RF conn.)
22	BITE LED	Status Indicator	n/a	n/a	N	n/a
23	Reset/Zeroize Switch	Reset unit settings to default	n/a	n/a	N	n/a
24	RF Port – Top	Various Frequency Antenna (Item 6, 9)	1	n/a	N	Item 24 (Type-N RF conn.)

Table 6. Ports and Cabling Information

H. Mode of Operation

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

I. Method of Monitoring EUT Operation

The DUT will "report in" to the controlling laptop's management application indicating that the DUT is still operating and relaying operational conditions.

J. Modifications

a) Modifications to EUT

The following modifications were needed to pass radiated emissions:

Internal USB Cable: Fair-Rite 2631540002 and 0461178181
Internal ETH0 Cable (PoE): Fair-Rite 2631540002

The DC-DC converter chassis grounded to circuit board.

b) Modifications to Test Standard

No modifications were made to the test standard.

K. Disposition of EUT

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

III. Electromagnetic Compatibility Criteria for Unintentional Radiators

Electromagnetic Compatibility Criteria

§ 15.107 Conducted Emissions Limits

Test Requirement(s):

15.107 (a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 7. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

15.107 (b) For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 7. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

15.207(a), Except as shown in paragraphs (b) and (c) of this section*, charging, AC adapters or battery eliminators the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the Table 7, as measured using a 50 µH/50 ohms 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 frequencies ranges.

Frequency range (MHz)	Class A Conducted Limits (dBµV)		*Class B Conducted Limits (dBµV)	
	Quasi-Peak	Average	Quasi-Peak	Average
* 0.15- 0.45	79	66	66 - 56	56 - 46
0.45 - 0.5	79	66	56	46
0.5 - 30	73	60	60	50
Note 1 — The lower limit shall apply at the transition frequencies. Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz. * -- Limits per Subsection 15.207(a).				

Table 7. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Subsections 15.107(a) (b) and 15.207(a)

Test Procedures: ANSI C63.4:2003 procedures were used.

Test Results: The EUT was found compliant with the Class A requirement(s) of this section. Measured emissions were below applicable limits.

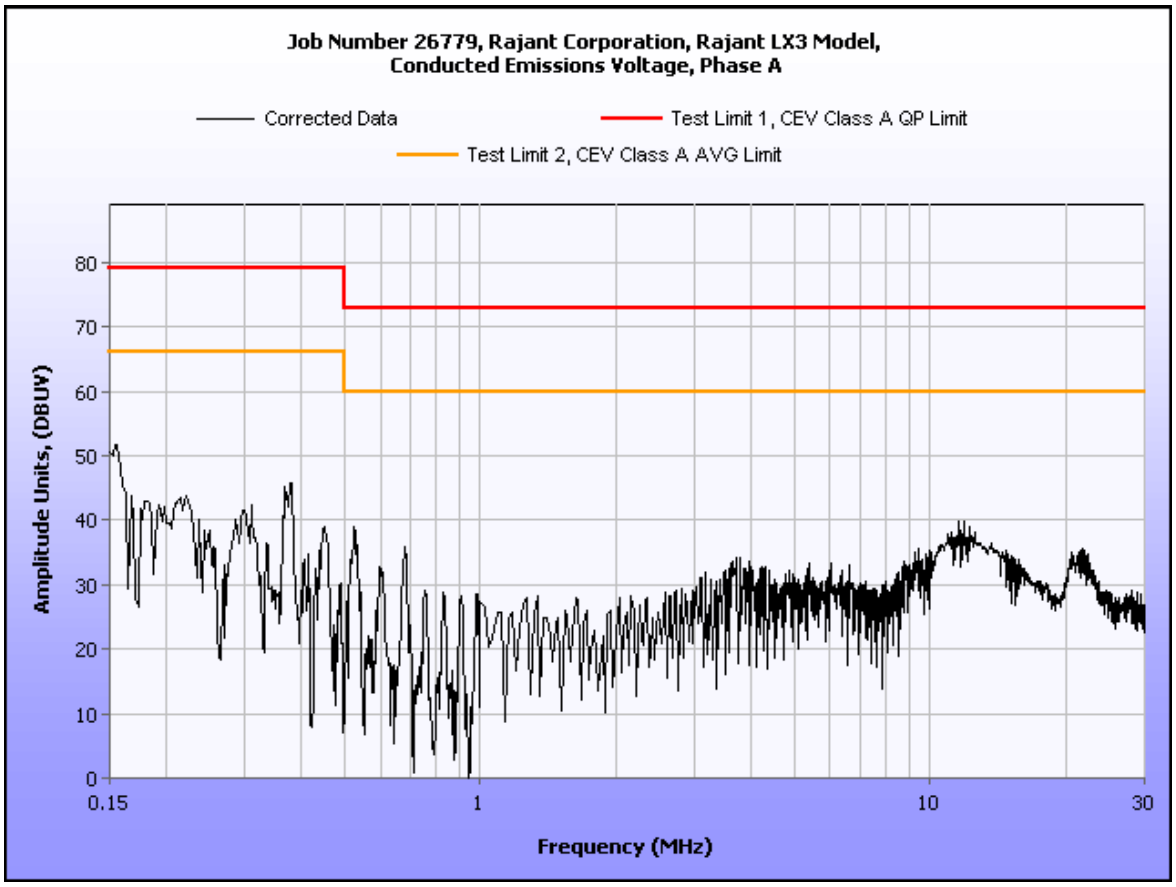
Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 04/17/09 and 12/16/09

Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz)

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
12.257	41.5	0.206112	41.706112	73	-31.2939	36.7	0.206112	36.906112	60	-23.0939
0.532	39.7	0.17	39.87	73	-33.13	26.2	0.17	26.37	60	-33.63
3.8	37.5	0.17	37.67	73	-35.33	31.1	0.17	31.27	60	-28.73
6.6	36.6	0.17	36.77	73	-36.23	33.6	0.17	33.77	60	-26.23
21.25	35.2	0.28875	35.48875	73	-37.5113	28.7	0.28875	28.98875	60	-31.0113
23.56	37.5	0.21252	37.71252	73	-35.2875	29.1	0.21252	29.31252	60	-30.6875

Table 8. Conducted Emissions - Voltage, AC Power, Phase Line (Model LX3-2495)

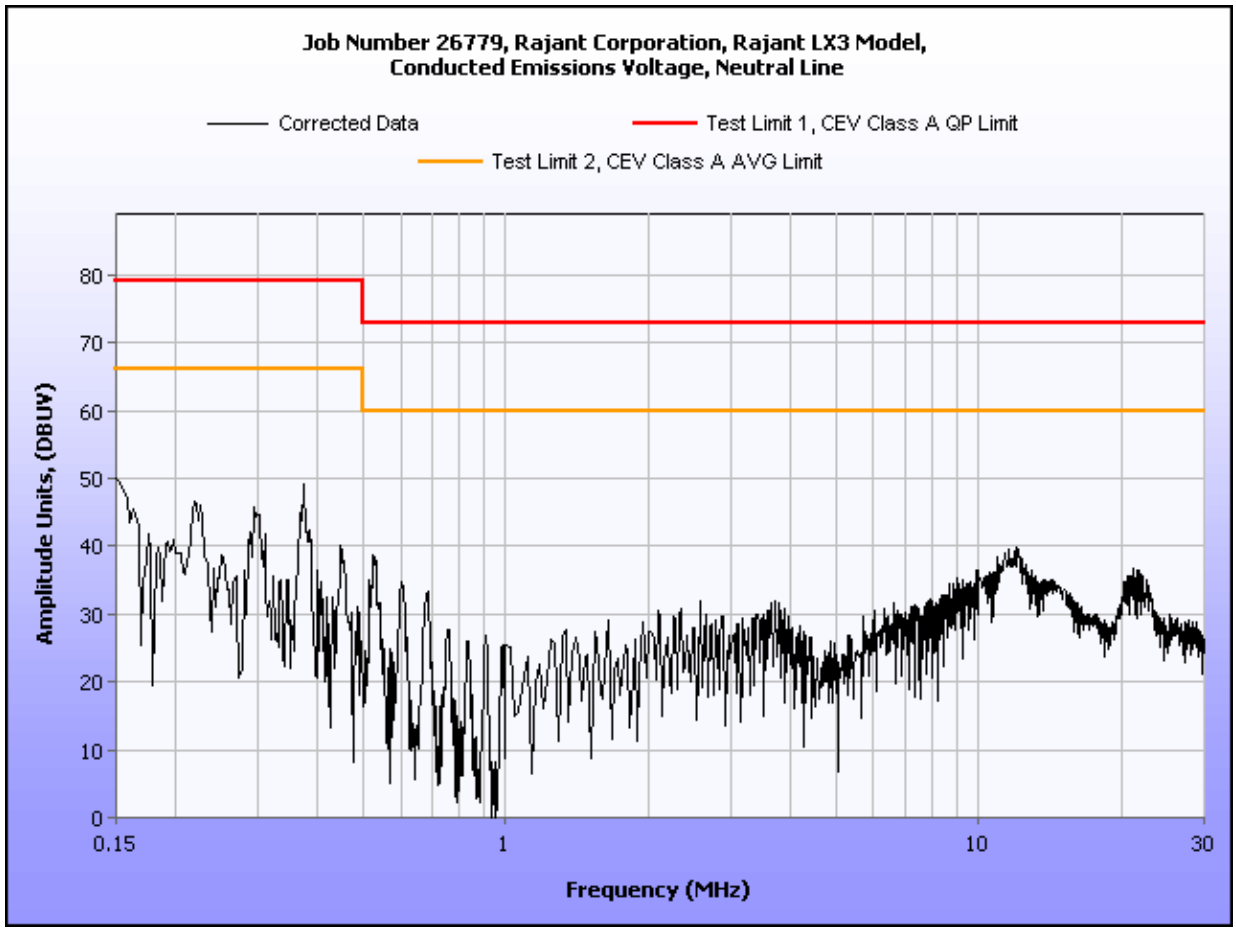


Plot 1. Conducted Emission, Phase Line Plot, (Model LX3-2495)

Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz)

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
0.534	40.2	0.17	40.37	73	-32.63	21.3	0.17	21.47	60	-38.53
11.671	39.9	0.196736	40.096736	73	-32.9033	36.4	0.196736	36.596736	60	-23.4033
3.81	35.8	0.17	35.97	73	-37.03	27.4	0.17	27.57	60	-32.43
20.52	35.3	0.31284	35.61284	73	-37.3872	28.4	0.31284	28.71284	60	-31.2872
3.73	34.2	0.17	34.37	73	-38.63	27.1	0.17	27.27	60	-32.73
6.94	34.2	0.17	34.37	73	-38.63	30.8	0.17	30.97	60	-29.03

Table 9. Conducted Emissions - Voltage, AC Power, Neutral Line (Model LX3-2495)



Plot 2. Conducted Emission, Neutral Line Plot, (Model LX3-2495)

Radiated Emission Limits

§ 15.109 Radiated Emissions Limits

Test Requirement(s): **15.109 (a)** Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the Class B limits expressed in Table 10.

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 10.

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

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

Test Results: The EUT was found to comply with the Class A requirement(s) of this section. Measured emissions were below applicable limits

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 04/17/09 and 12/16/09

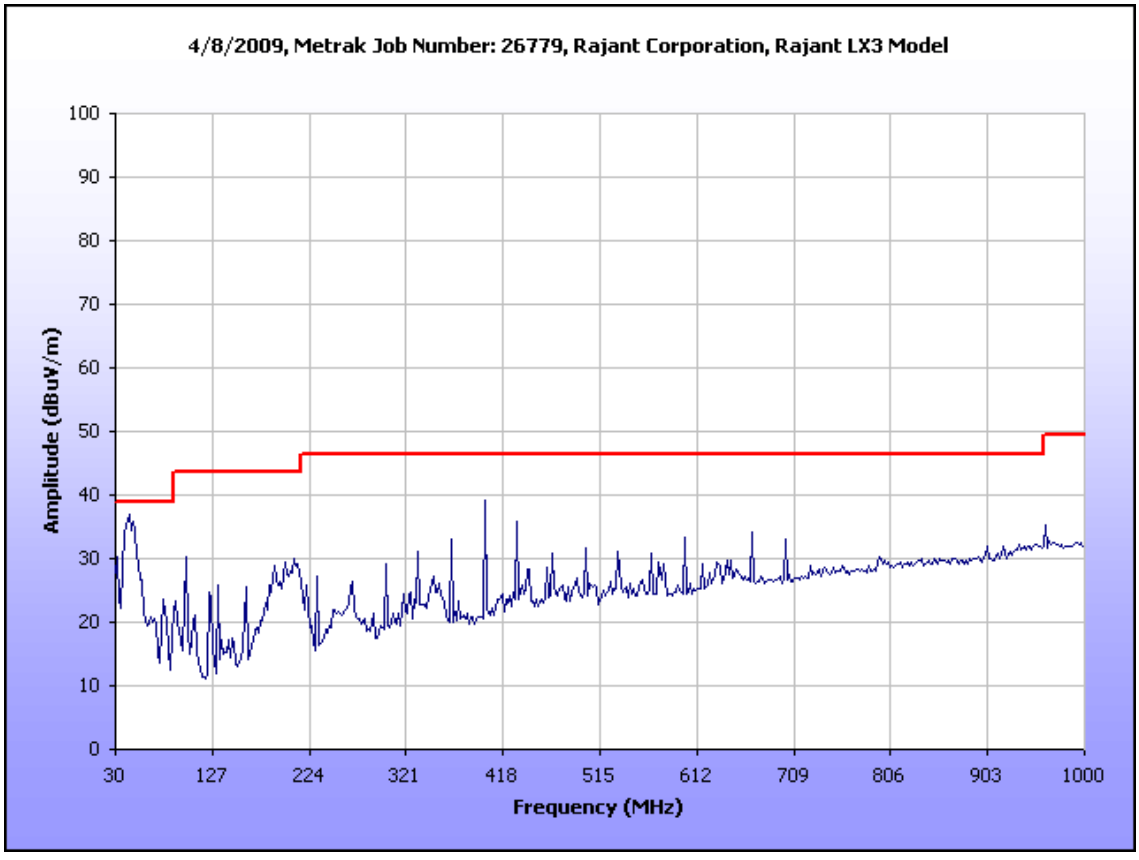
Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna Height (m)	Uncorrected EMI Meter Reading (dBuV)	Antenna Correction Factor (dB/m) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
444.51102	202	H	0.9995	29.05	16.91	2.01	10.46	37.51	46.4	-8.89
444.51102	0	V	1.67	34	16.91	2.01	10.46	42.46	46.4	-3.94
333.31062*	130	H	1	35.39	16.91	1.61	10.46	43.45	46.4	-2.95
333.31062*	361	V	0.9869	40.23	14.43	1.61	10.46	45.81	46.4	-0.59
555.52305	112	H	1.8904	31.5	16.91	2.47	10.46	40.42	46.4	-5.98
555.52305*	219	V	1.2421	33.54	18.59	2.47	10.46	44.14	46.4	-2.26
88.901804	181	H	0.9995	25.57	16.91	0.21	10.46	32.23	43.5	-11.27
88.901804	301	V	0.9873	43.3	6.37	0.21	10.46	39.41	43.5	-4.09
399.96944*	108	H	1	36.19	16.91	1.87	10.46	44.51	46.4	-1.89
399.96944	162	V	0.9873	33.09	15.50	1.87	10.46	40.00	46.4	-6.40
200.01403	361	H	2.6069	22.82	16.91	0.39	10.46	29.66	43.5	-13.84
200.01403	91	V	0.9869	35.19	10.20	0.39	10.46	35.32	43.5	-8.18
47.370491	280	H	2.8	25.5	16.91	0.21	10.46	32.16	39	-6.84
47.370491*	360	V	1	38.29	8.39	0.21	10.46	36.43	39	-2.57

Table 11. Radiated Emissions Limits Test Results, 30 MHz – 1GHz, Model LX3-2495 (DC POE)

Notes: * - At this frequency, the measured electric-field strength exhibits a margin of compliance that is less than 3 dB below the specification limit. We recommend that every emission measured, have at least a 3 dB margin to allow for deviations in the emission characteristics that may occur during the production process.

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



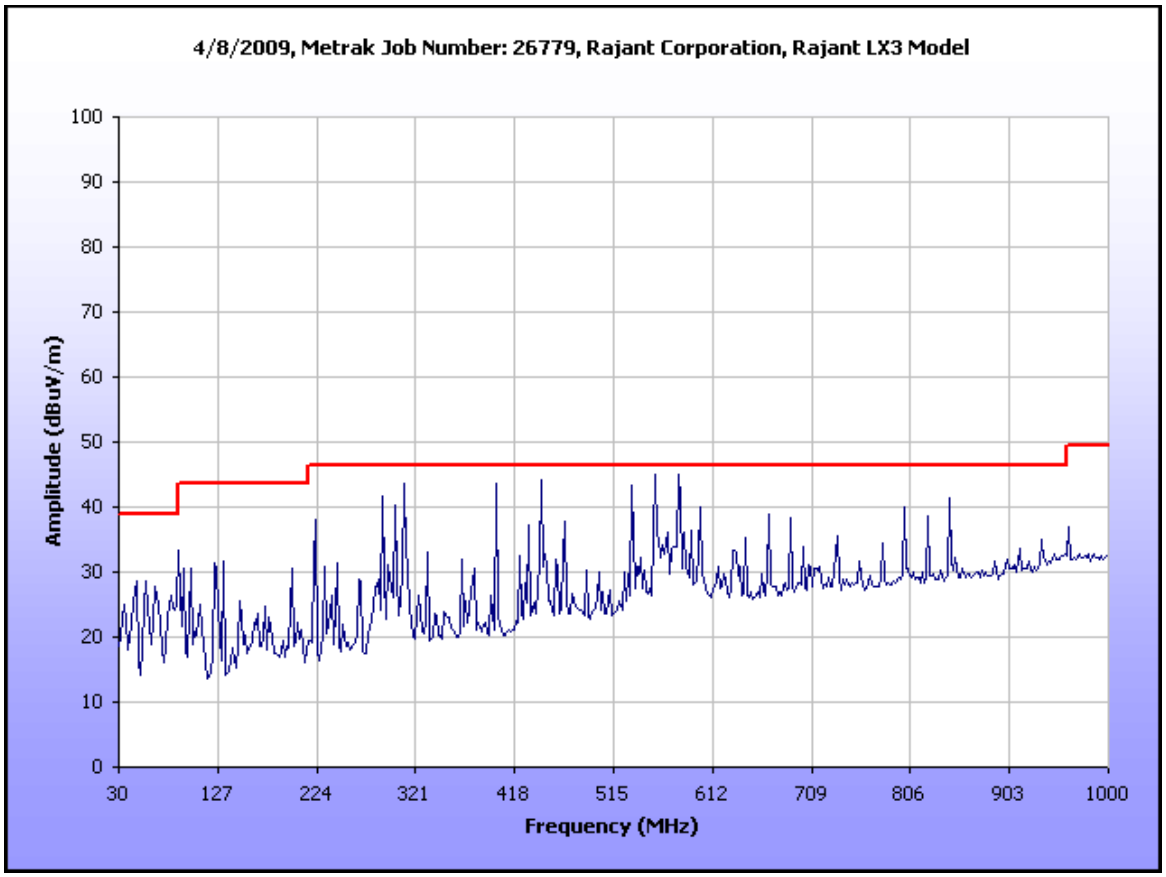
Plot 3. Radiated Emissions Limits Test Results, 30 MHz – 1 GHz, Model LX3-2495 (DC POE)

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna Height (m)	Uncorrected EMI Meter Reading (dBuV)	Antenna Correction Factor (dB/m) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
444.39078	91	H	1	34.89	16.46	2.01	10.46	42.91	46.4	-3.49
444.39078*	143	V	1	37	16.91	2.01	10.46	45.46	46.4	-0.94
399.96443*	48	H	3	37.86	15.50	1.87	10.46	44.77	46.4	-1.63
399.96443*	60	V	1	38.99	15.50	1.87	10.46	45.90	46.4	-0.50
577.68938	309	H	1	28.9	18.55	2.49	10.46	39.47	46.4	-6.93
577.68938	345	V	1.4	31.25	18.38	2.49	10.46	41.66	46.4	-4.74
333.30686	78	H	1	33.69	13.83	1.61	10.46	38.67	46.4	-7.73
333.30686	0	V	1.6	36.54	14.43	1.61	10.46	42.12	46.4	-4.28
64.767786	99	H	2.7	18.92	10.20	0.24	10.46	18.90	39	-20.10
64.767786	312	V	1	34.71	9.90	0.24	10.46	34.38	39	-4.62
799.92936	183	H	1	19.98	21.50	2.99	10.46	34.01	46.4	-12.39
799.92936	76	V	1	22.41	21.60	2.99	10.46	36.54	46.4	-9.86

Table 12. Radiated Emissions Limits Test Results, 30 MHz – 1GHz, Model LX3-2495(AC POE)

Notes: * - At this frequency, the measured electric-field strength exhibits a margin of compliance that is less than 3 dB below the specification limit. We recommend that every emission measured, have at least a 3 dB margin to allow for deviations in the emission characteristics that may occur during the production process.

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



Plot 4. Radiated Emissions Limits Test Results, 30 MHz – 1 GHz, Model LX3-2495 (AC POE)

Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna Height (m)	Uncorrected EMI Meter Reading (dBuV)	Antenna Correction Factor (dB/m) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
444.51102	202	H	0.9995	29.05	16.91	2.01	10.46	37.51	47	-9.49
444.51102	0	V	1.67	34	16.91	2.01	10.46	42.46	47	-4.54
333.31062	130	H	1	35.39	16.91	1.61	10.46	43.45	47	-3.55
333.31062*	361	V	0.9869	40.23	14.43	1.61	10.46	45.81	47	-1.19
555.52305	112	H	1.8904	31.5	16.91	2.47	10.46	40.42	47	-6.58
555.52305*	219	V	1.2421	33.54	18.59	2.47	10.46	44.14	47	-2.86
88.901804	181	H	0.9995	25.57	16.91	0.21	10.46	32.23	40	-7.77
88.901804*	301	V	0.9873	43.3	6.37	0.21	10.46	39.41	40	-0.59
399.96944*	108	H	1	36.19	16.91	1.87	10.46	44.51	47	-2.49
399.96944	162	V	0.9873	33.09	15.50	1.87	10.46	40.00	47	-7.00
200.01403	361	H	2.6069	22.82	16.91	0.39	10.46	29.66	40	-10.34
200.01403	91	V	0.9869	35.19	10.20	0.39	10.46	35.32	40	-4.68
47.370491	280	H	2.8	25.5	16.91	0.21	10.46	32.16	40	-7.84
47.370491	360	V	1	38.29	8.39	0.21	10.46	36.43	40	-3.57

Table 13. ICES-003 Radiated Emissions Limits Test Results, 30 MHz – 1GHz, Model LX3-2495 (DC POE)

Notes: * - At this frequency, the measured electric-field strength exhibits a margin of compliance that is less than 3 dB below the specification limit. We recommend that every emission measured, have at least a 3 dB margin to allow for deviations in the emission characteristics that may occur during the production process.

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

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna Height (m)	Uncorrected EMI Meter Reading (dBuV)	Antenna Correction Factor (dB/m) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
444.39078	91	H	1	34.89	16.46	2.01	10.46	42.91	47	-4.09
444.39078*	143	V	1	37	16.91	2.01	10.46	45.46	47	-1.54
399.96443*	48	H	3	37.86	15.50	1.87	10.46	44.77	47	-2.23
399.96443*	60	V	1	38.99	15.50	1.87	10.46	45.90	47	-1.10
577.68938	309	H	1	28.9	18.55	2.49	10.46	39.47	47	-7.53
577.68938	345	V	1.4	31.25	18.38	2.49	10.46	41.66	47	-5.34
333.30686	78	H	1	33.69	13.83	1.61	10.46	38.67	47	-8.33
333.30686	0	V	1.6	36.54	14.43	1.61	10.46	42.12	47	-4.88
64.767786	99	H	2.7	18.92	10.20	0.24	10.46	18.90	40	-21.10
64.767786	312	V	1	34.71	9.90	0.24	10.46	34.38	40	-5.62
799.92936	183	H	1	19.98	21.50	2.99	10.46	34.01	47	-12.99
799.92936	76	V	1	22.41	21.60	2.99	10.46	36.54	47	-10.46

Table 14. ICES-003 Radiated Emissions Limits Test Results, 30 MHz – 1GHz, Model LX3-2495(AC POE)

Notes: * - At this frequency, the measured electric-field strength exhibits a margin of compliance that is less than 3 dB below the specification limit. We recommend that every emission measured, have at least a 3 dB margin to allow for deviations in the emission characteristics that may occur during the production process.

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

IV. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 Antenna Requirement

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

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

a.) Antenna must be permanently attached to the unit.

b.) Antenna must use a unique type of connector to attach to the EUT.

c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

Results: The EUT as tested meets the criteria of this rule by virtue of having professionally installed antennas. The EUT is therefore compliant with §15.203.

Gain/Model	Manufacturer
5 dBi (900 MHz)	Pacific Wireless
5 dBi (2.4 GHz)	Pacific Wireless
6 dBi (5.8 GHz)	Terrawave Solutions

Test Engineer(s): Dusmantha Tennakoon

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 μH/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 (dBμV)	
	Quasi-Peak	Average
* 0.15- 0.45	66 - 56	56 - 46
0.45 - 0.5	56	46
0.5 - 30	60	50

Table 15. 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 Ω/50 μH 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 C63.4-2003 "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 Ω/50 μH 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.

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): Dusmantha Tennakoon

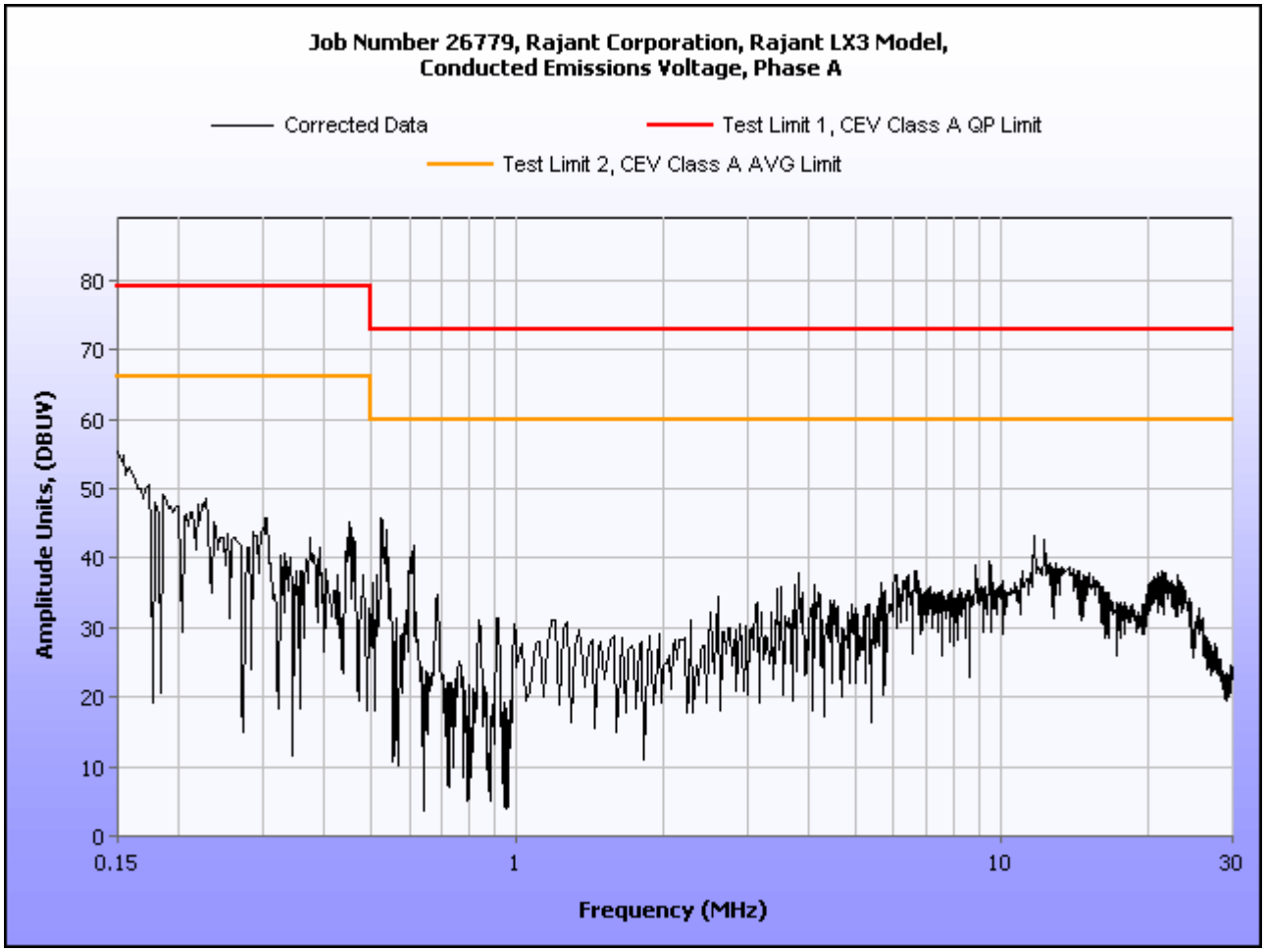
Test Date(s): 04/17/09

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
12.257	41.5	0.206112	41.706112	60	-18.2939	36.7	0.206112	36.906112	50	-13.0939
0.532	39.7	0.17	39.87	56	-16.13	26.2	0.17	26.37	46	-19.63
3.8	37.5	0.17	37.67	56	-18.33	31.1	0.17	31.27	46	-14.73
6.6	36.6	0.17	36.77	60	-23.23	33.6	0.17	33.77	50	-16.23
21.25	35.2	0.28875	35.48875	60	-24.5113	28.7	0.28875	28.98875	50	-21.0113
23.56	37.5	0.21252	37.71252	60	-22.2875	29.1	0.21252	29.31252	50	-20.6875

Table 16. Conducted Emissions - Voltage, AC Power, Phase Line (Model LX3-2495)

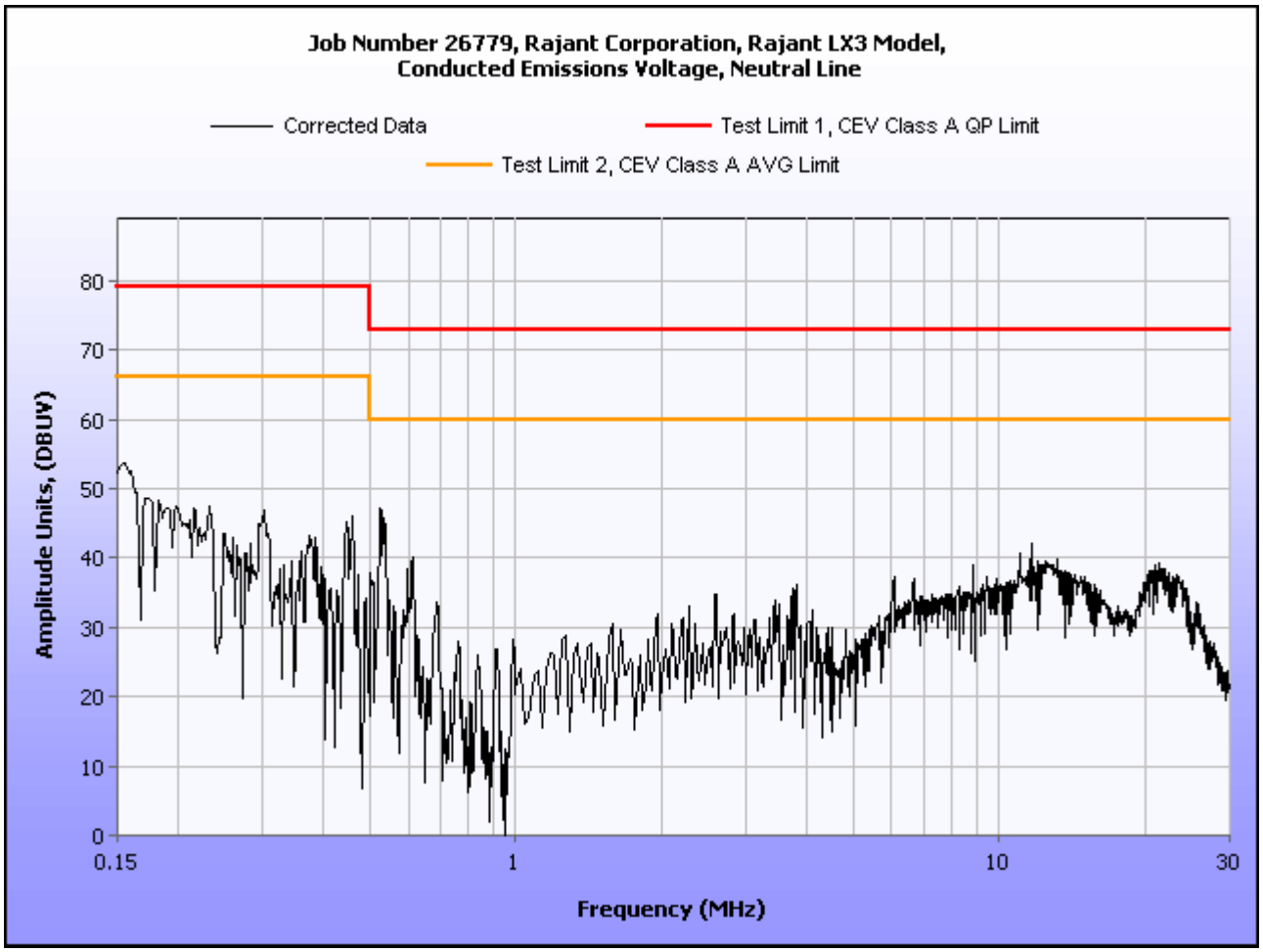


Plot 5. Conducted Emission, Phase Line Plot, (Model LX3-2495)

Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz)

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
0.534	40.2	0.17	40.37	56	-15.63	21.3	0.17	21.47	46	-24.53
11.671	39.9	0.196736	40.096736	60	-19.9033	36.4	0.196736	36.596736	50	-13.4033
3.81	35.8	0.17	35.97	56	-20.03	27.4	0.17	27.57	46	-18.43
20.52	35.3	0.31284	35.61284	60	-24.3872	28.4	0.31284	28.71284	50	-21.2872
3.73	34.2	0.17	34.37	56	-21.63	27.1	0.17	27.27	46	-18.73
6.94	34.2	0.17	34.37	60	-25.63	30.8	0.17	30.97	50	-19.03

Table 17. Conducted Emissions - Voltage, AC Power, Neutral Line (Model LX3-2495)



Plot 6. Conducted Emission, Neutral Line Plot, (Model LX3-2495)

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(a) 6 dB and 99% Bandwidth

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

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

Test Results Equipment complies with § 15.247 (a). Please refer to FCC IDs: SWX-XR2, SWX-XR5 & SWX-XR9 for the 6 dB and 99% Bandwidth results.

Test Engineer(s): Dusmantha Tennakoon

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(b) Peak Power Output and RF Exposure

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

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

Table 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.

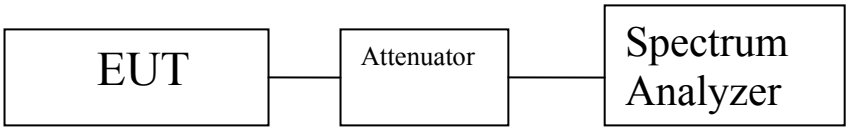
Fixed, point-to-point operation excludes the use of point-to-multipoint systems, omni-directional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the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

Test Procedure: The EUT was measured at the low, mid and high channels of each band at a data rate which gave the maximum power level.

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

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 04/20/09



Block Diagram 1. Peak Power Output Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators
RF Output Power Test Results – Model LX3-2495

Mode	Channel #	Power (dBm)	Maximum Antenna gain (dBi)	Limit (dBm)	Pass/Fail
b mode	1	26.79	5	30	Pass
	6	28.75	5	30	Pass
	11	27.52	5	30	Pass
g mode	1	25.4	5	30	Pass
	6	27.9	5	30	Pass
	11	25.01	5	30	Pass
a mode	149	26.25	6	30	Pass
	157	26.03	6	30	Pass
	165	26.07	6	30	Pass

Table 19. RF Output Power Test Results, 2.4GHz & 5.8GHz

Mode	Frequency (MHz)	Conducted Peak power (dBm)	Maximum Antenna Gain (dBi)	Limit (dBm)	Pass/Fail
b mode	907	27.43	5	30	Pass
	912	27.35	5	30	Pass
	922	27.48	5	30	Pass
g mode	907	24.35	5	30	Pass
	912	24.41	5	30	Pass
	922	24.77	5	30	Pass

Table 20. RF Output Power Test Results, 900MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(b) Peak Power Output and 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.

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

2.4 GHz Band	**5.8 GHz**	**900 MHz**
$S = PG/4\pi R^2$	$S = PG/4\pi R^2$	$S = PG/4\pi R^2$
$\frac{(751.67mW)(3.16)}{4\pi(20)^2}$	$\frac{(422.69mW)(3.98)}{4\pi(20)^2}$	$\frac{(561.09mW)(3.16)}{4\pi(20)^2}$
$S1 = 0.472mW/cm^2$	$S2 = 0.335mW/cm^2$	$S3 = 0.353mW/cm^2$

1. 900 MHz radio co-located with 5.8 GHz radio:

S	Power density (mW/cm²)	General Population Limit (mW/cm²)	S as a fraction of the limit (%)
S2	0.335	1	33.5
S3	0.353	0.61	57.8

2. 5.8 GHz radio co-located with 2.4 GHz radio:

S	Power density (mW/cm²)	General Population Limit (mW/cm²)	S as a fraction of the limit (%)
S1	0.472	1	47.2
S2	0.335	1	33.5

The total percentages do not exceed 100 % per OET 65 requirements when the spectral power density is calculated at least 20cm away from the unit. The 2.4 GHz and 900 MHz radio are not co-located.

Therefore, the EUTs meet the Uncontrolled Exposure limit.

Test Engineer(s): Dusmantha Tennakoon

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Harmonic Emissions – Radiated and Conducted

Test Requirements: **§15.247(d)**; **§ 15.209 (a); §15.205:** Emissions outside the frequency band.

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

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

MHz	MHz	MHz	GHz
0.090–0.110----------	16.42–16.423	399.9–410	4.5–5.15
[1] 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	([2])

Table 21. Restricted Bands of Operation

[1] Until February 1, 1999, this restricted band shall be 0.490 – 0.510 MHz.
[2] Above 38.6

Test Requirement(s): **§ 15.209 (a):** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in Table 22.

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

Table 22. Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a)

Test Procedure: The transmitter was set to the mid channel at the highest output power and placed o inside in a semi-anechoic chamber. Measurements were performed with the EUT rotated 360 degrees and varying the adjustable antenna mast with 1 m to 4 m height to determine worst case orientation for maximum emissions. Measurement were repeated the measurement at the low and highest channels.

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.

Test Results: The EUT was found compliant with the Radiated Emission limits of **§15.209(a)** for Intentional Radiators. See following pages for detailed test results.

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 04/20/09

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Harmonic Emissions Requirements – Radiated (802.11b/g) – 900 MHz radio

Frequency (MHz)	Antenna Polarity	Corrected Amplitude @ 3m (dBuV/m)	Restricted Band	Measurement Type	Limit
1814	V	39.64	No	Peak	>20dBc
2721	V	68.29	Yes	Peak	74
2721	V	36.94	Yes	Avg.	54
3628	V	39.7	Yes	Peak	74
3628	V	21.52	Yes	Avg.	54

Table 23. Spurious Radiated Emissions, 802.11b/g modes (907 MHz)

Frequency (MHz)	Antenna Polarity	Corrected Amplitude @ 3m (dBuV/m)	Restricted Band	Measurement Type	Limit
1824	V	34.63	No	Peak	>20dBc
2736	V	67.78	Yes	Peak	74
2736	V	37.19	Yes	Avg.	54
3648	V	39.27	Yes	Peak	74
3648	V	32.33	Yes	Avg.	54

Table 24. Spurious Radiated Emissions, 802.11b/g modes (912 MHz)

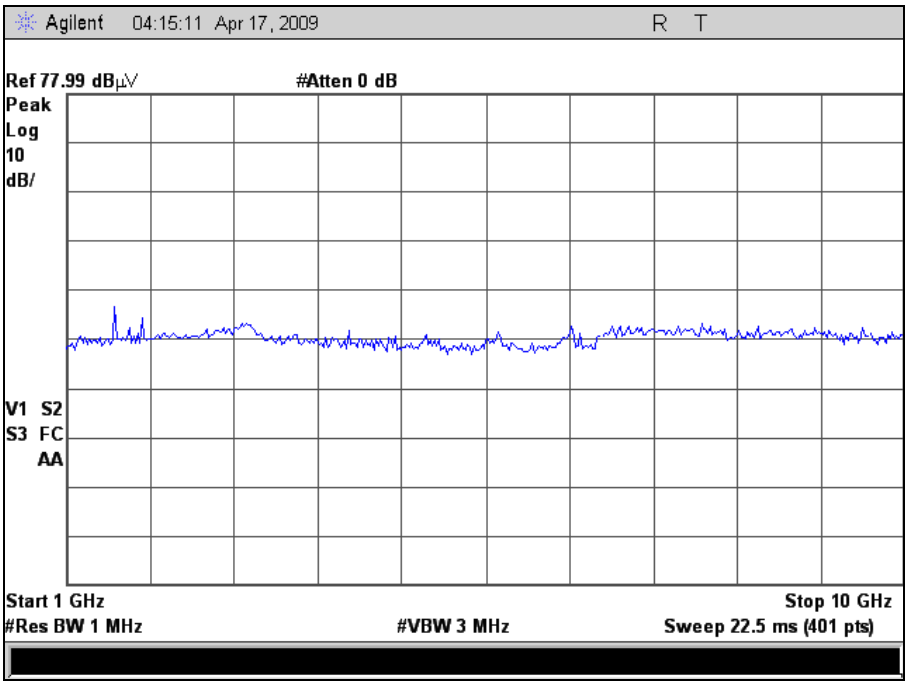
Frequency (MHz)	Antenna Polarity	Corrected Amplitude @ 3m (dBuV/m)	Restricted Band	Measurement Type	Limit
1844	V	29.83	No	Peak	>20dBc
2766	V	61.09	Yes	Peak	74
2766	V	35.18	Yes	Avg.	54
3688	V	28.79	Yes	Peak	74
3688	V	21.59	Yes	Avg.	54

Table 25. Spurious Radiated Emissions, 802.11b/g modes (922 MHz)

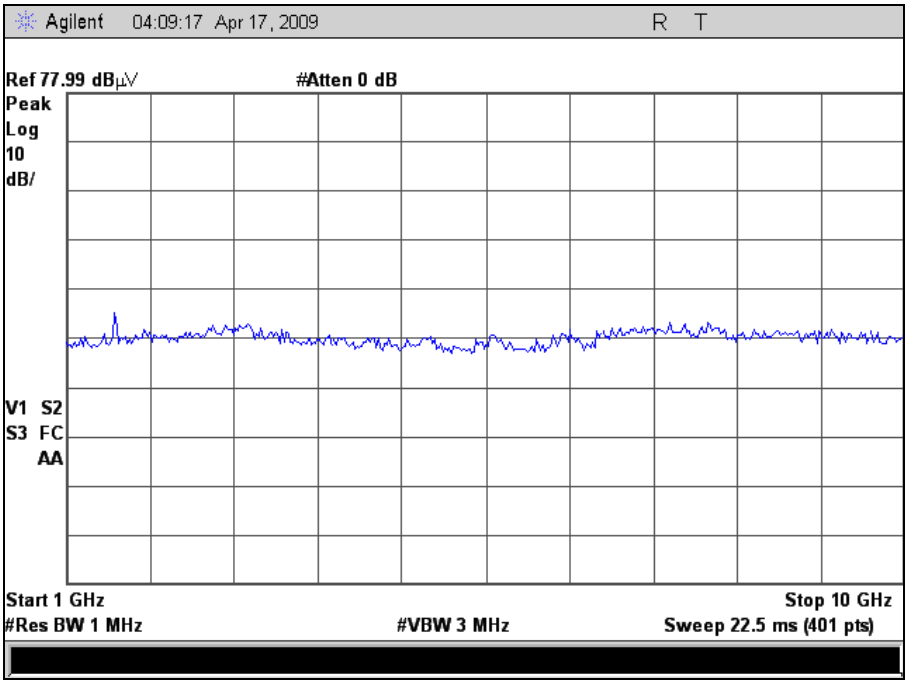
Note: All other emissions were measured at the noise floor of the spectrum analyzer

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Harmonic Emissions Requirements – Radiated (802.11b/g)



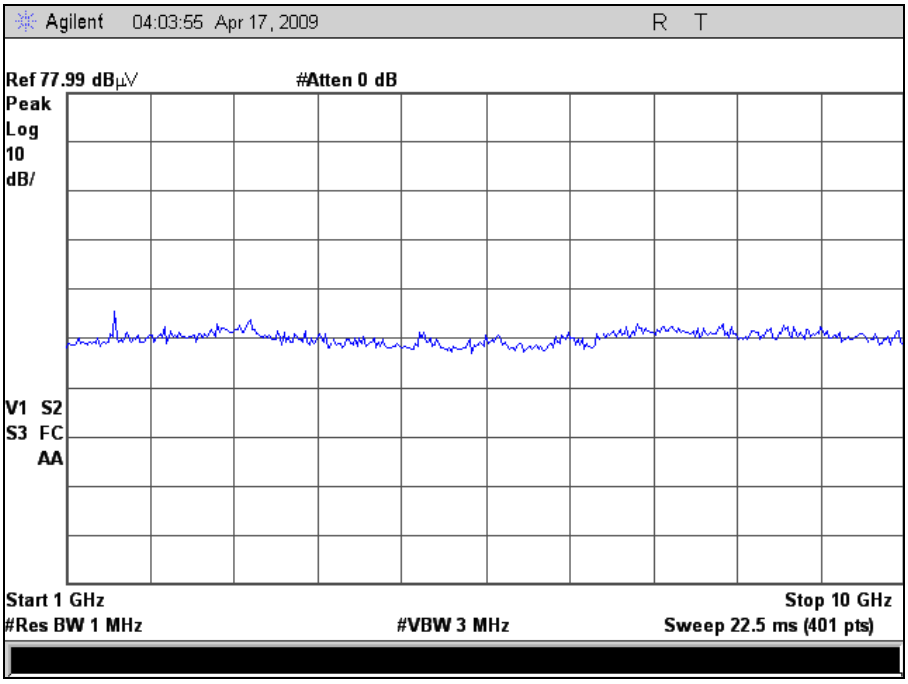
Plot 7. 907MHz Low Channel, 1-10GHz (b mode)



Plot 8. 912MHz Mid Channel, 1-10GHz (b mode)

Electromagnetic Compatibility Criteria for Intentional Radiators

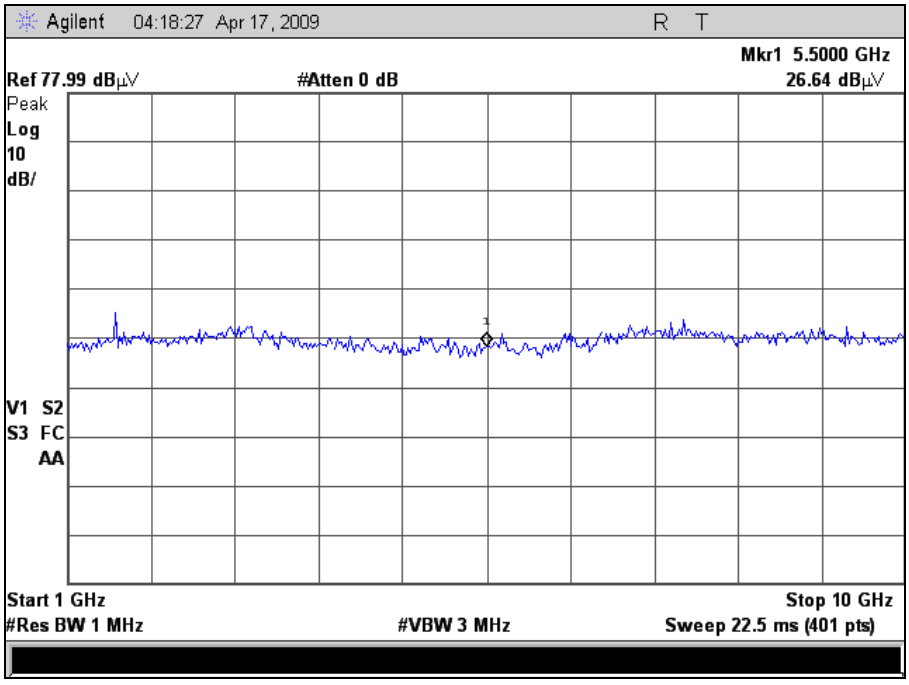
§ 15.247(d) Harmonic Emissions Requirements – Radiated (802.11b/g)



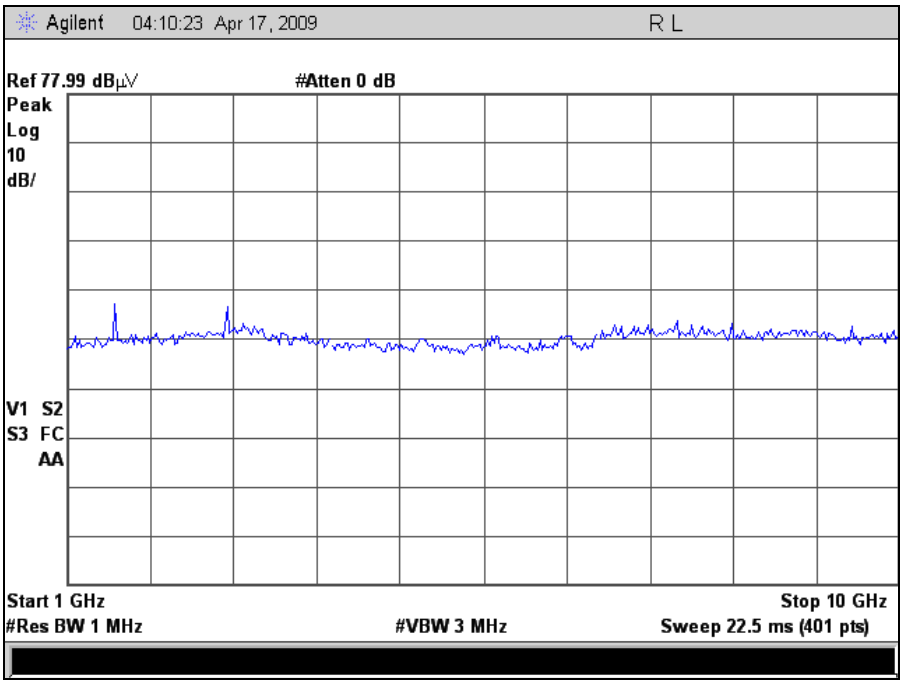
Plot 9. 922MHz High Channel, 1-10GHz (b mode)

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Harmonic Emissions Requirements – Radiated (802.11b/g)



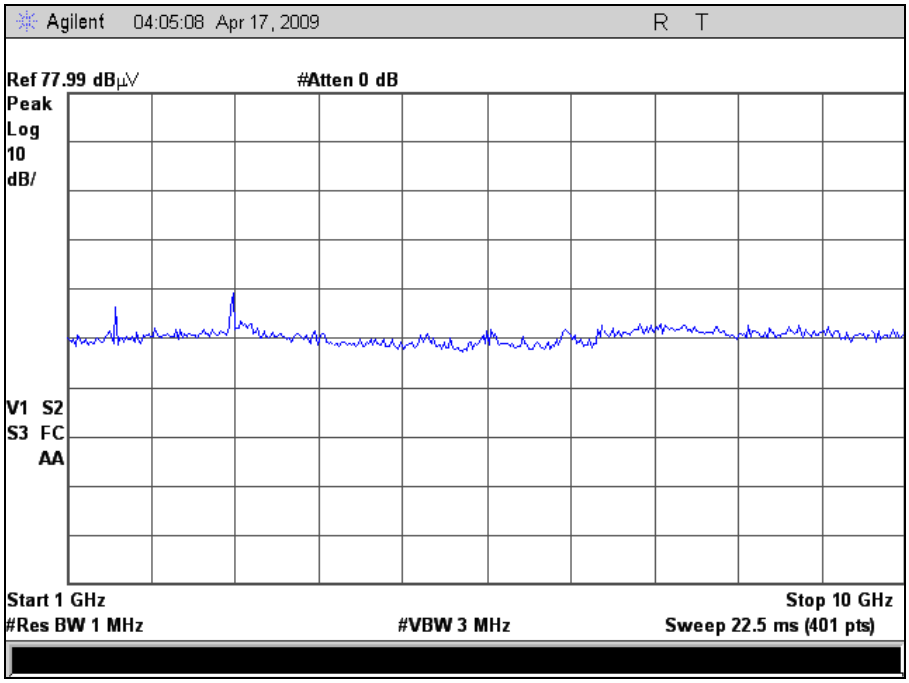
Plot 10. 907MHz Low Channel, 1-10GHz (g mode)



Plot 11. 912MHz Mid Channel, 1-10GHz (g mode)

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Harmonic Emissions Requirements – Radiated (802.11b/g)



Plot 12. 922MHz High Channel, 1-10GHz (g mode)

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Harmonic Emissions Requirements – Radiated (802.11b/g) – 2.4 GHz radio

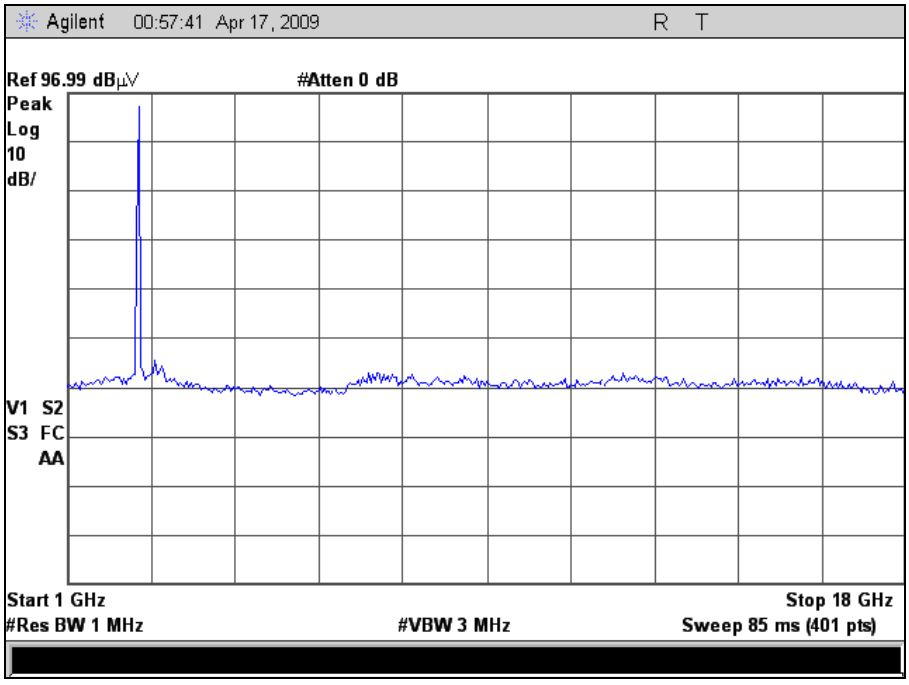
Mode	Channel	Frequency (GHz)	Final measurement corrected for cable loss, preamp, ACF and distance (dBuV/m)	Limit (dBuV/m)	Remark	Pass/Fail
b	1	4.824	37.52	74	Peak	Pass
		4.824	33.17	54	Avg.	Pass
		7.236	39.05	>20 dBc	Peak	Pass
		9.648	35.09	>20 dBc	Peak	Pass
	6	4.874	36.64	74	Peak	Pass
		4.874	32.94	54	Avg.	Pass
		7.311	37.68	74	Peak	Pass
		7.311	31.33	54	Avg.	Pass
		9.748	38.42	>20 dBc	Peak	Pass
	11	4.924	36.21	74	Peak	Pass
		4.924	32.1	54	Avg.	Pass
		7.386	37.23	74	Peak	Pass
		7.386	27.06	54	Avg.	Pass
		9.848	35.21	>20 dBc	Peak	Pass
g	1	4.824	31.23	74	Peak	Pass
		4.824	19.33	54	Avg.	Pass
		7.236	33.47	>20 dBc	Peak	Pass
		9.648	30.58	>20 dBc	Peak	Pass
	6	4.874	32	74	Peak	Pass
		4.874	21.31	54	Avg.	Pass
		7.311	31.24	74	Peak	Pass
		7.311	20.59	54	Avg.	Pass
		9.748	30.56	>20 dBc	Peak	Pass
	11	4.924	34.56	74	Peak	Pass
		4.924	22.99	54	Avg.	Pass
		7.386	37.49	74	Peak	Pass
		7.386	26.3	54	Avg.	Pass
		9.848	36.59	>20 dBc	Peak	Pass

Table 26. Spurious Radiated Emissions, 802.11b/g modes (2412-2462MHz)

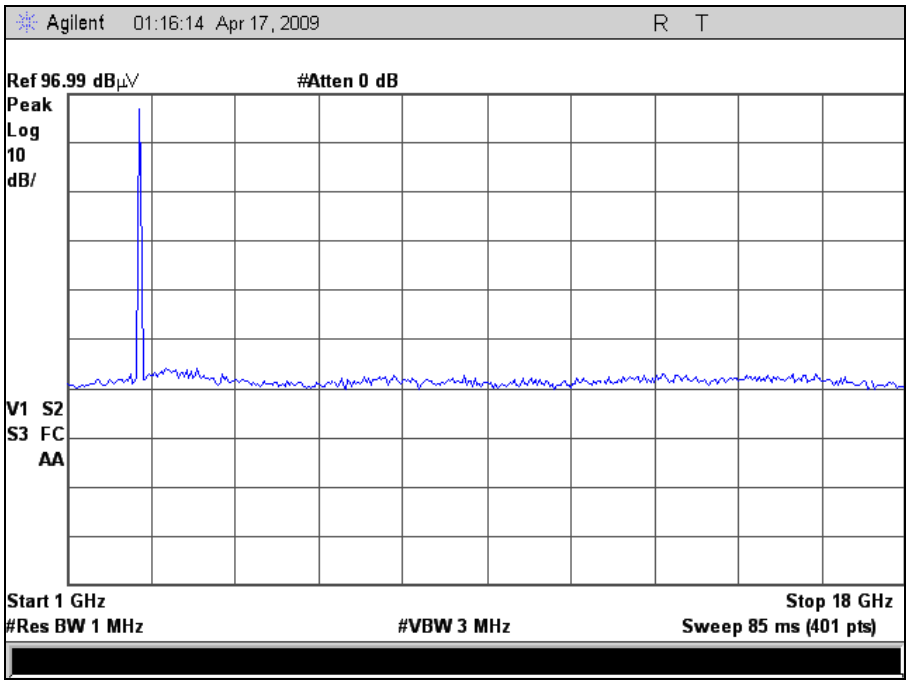
Note: All other emissions were measured at the noise floor of the spectrum analyzer

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Harmonic Emissions Requirements – Radiated (802.11b)



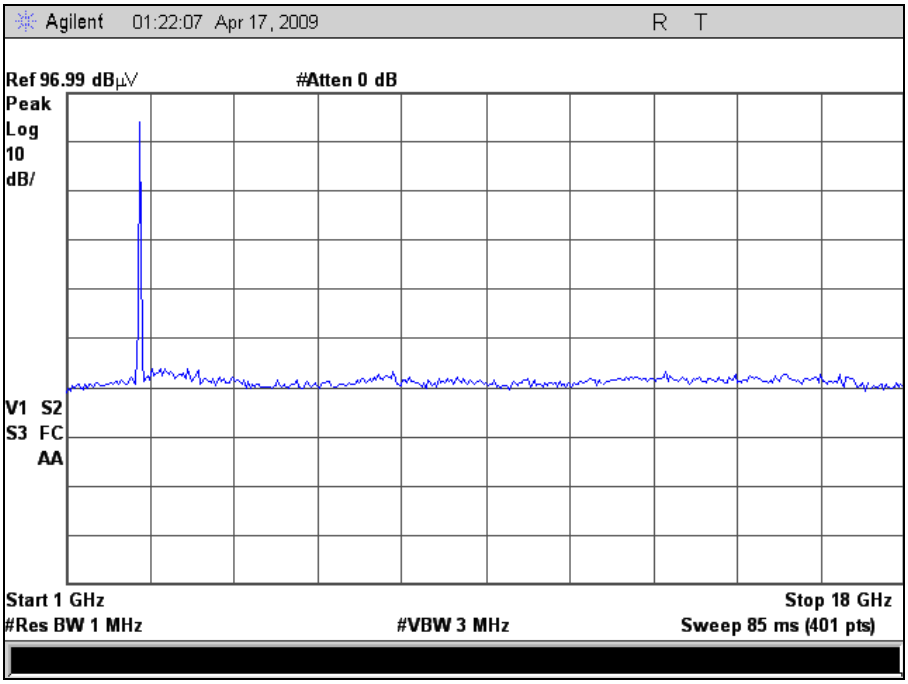
Plot 13. 2.4GHz Low Channel, 1-18GHz (b mode)



Plot 14. 2.4GHz Mid Channel, 1-18GHz (b mode)

Electromagnetic Compatibility Criteria for Intentional Radiators

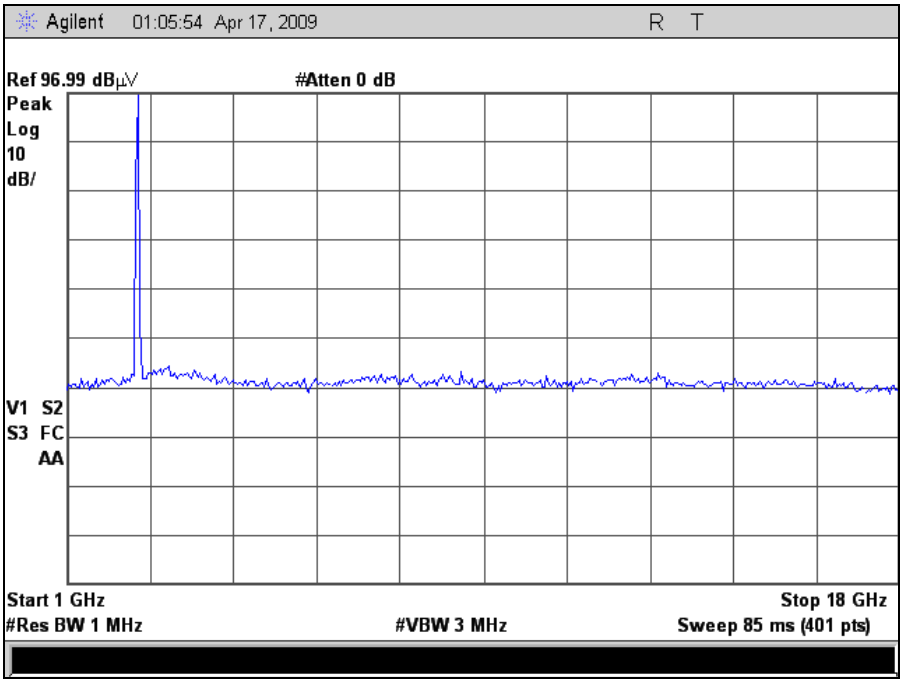
§ 15.247(d) Harmonic Emissions Requirements – Radiated (802.11b)



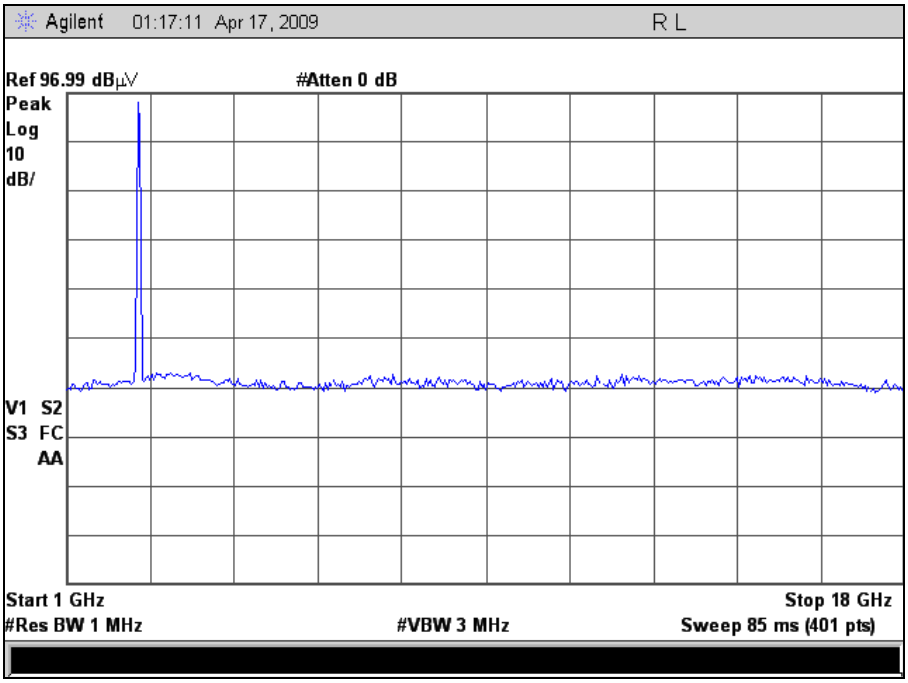
Plot 15. 2.4GHz High Channel, 1-18GHz (b mode)

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Harmonic Emissions Requirements – Radiated (802.11g)



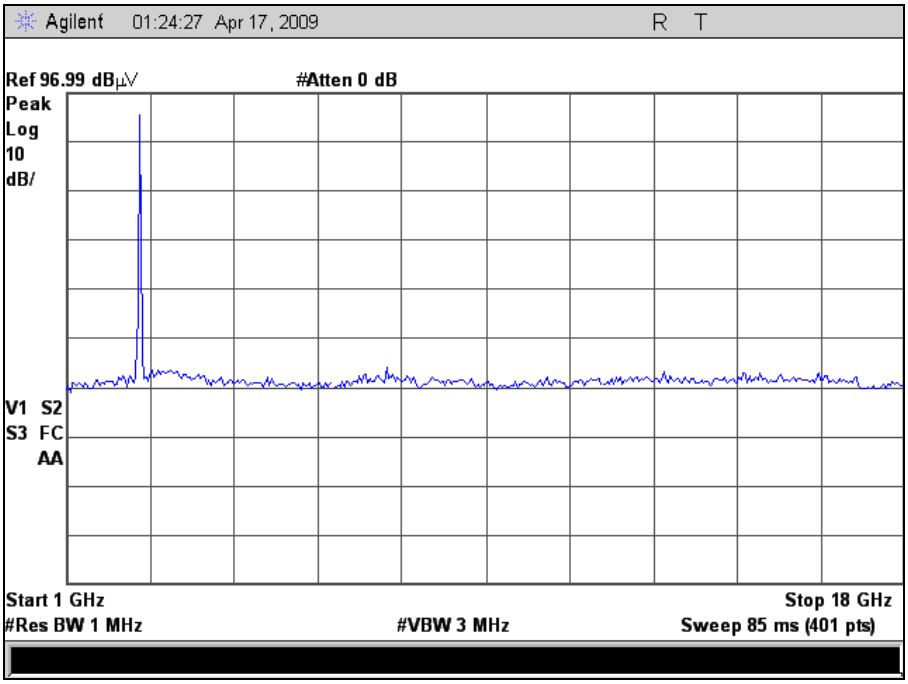
Plot 16. 2.4GHz Low Channel, 1-18GHz (g mode)



Plot 17. 2.4GHz Mid Channel, 1-18GHz (g mode)

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Harmonic Emissions Requirements – Radiated (802.11g)



Plot 18. 2.4GHz High Channel, 1-18GHz (g mode)

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Harmonic Emissions Requirements – Radiated (802.11a) – 5.8 GHz radio

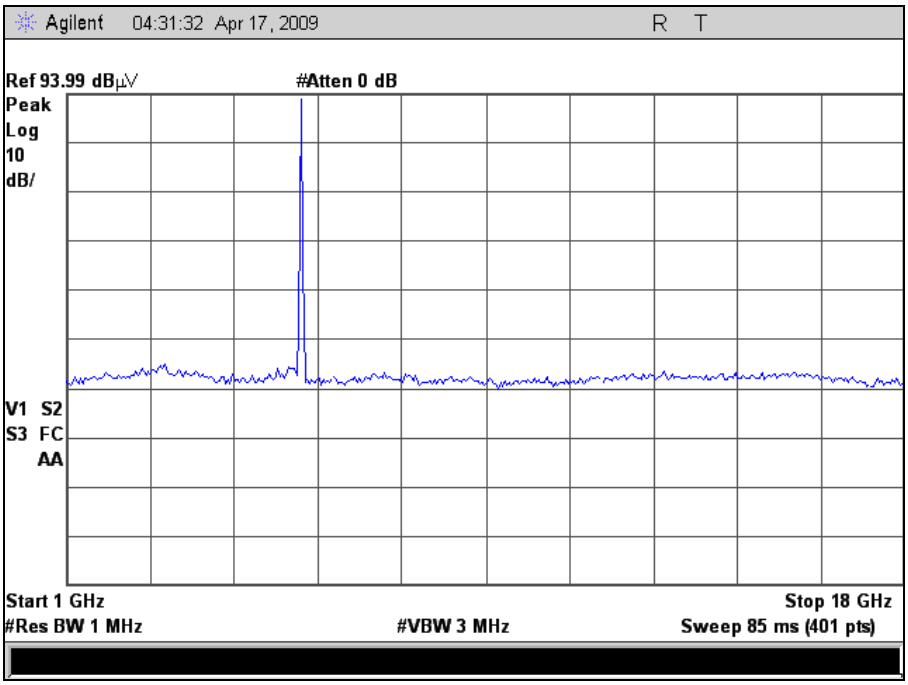
Channel	Frequency (GHz)	Final measurement corrected for cable loss, preamp, ACF and distance (dBuV/m)	Limit (dBuV/m)	Remark	Pass/Fail
149	11.49	54.87	74	Peak	Pass
	11.49	41.67	54	Avg.	Pass
	17.235	53.18	>20 dBc	Peak	Pass
157	11.57	57.72	74	Peak	Pass
	11.57	45.57	54	Avg.	Pass
	17.355	57.8	>20 dBc	Peak	Pass
165	11.65	58.58	74	Peak	Pass
	11.65	45.98	54	Avg.	Pass
	17475	58.5	>20 dBc	Peak	Pass

Table 27. Spurious Radiated Emissions, 802.11a mode

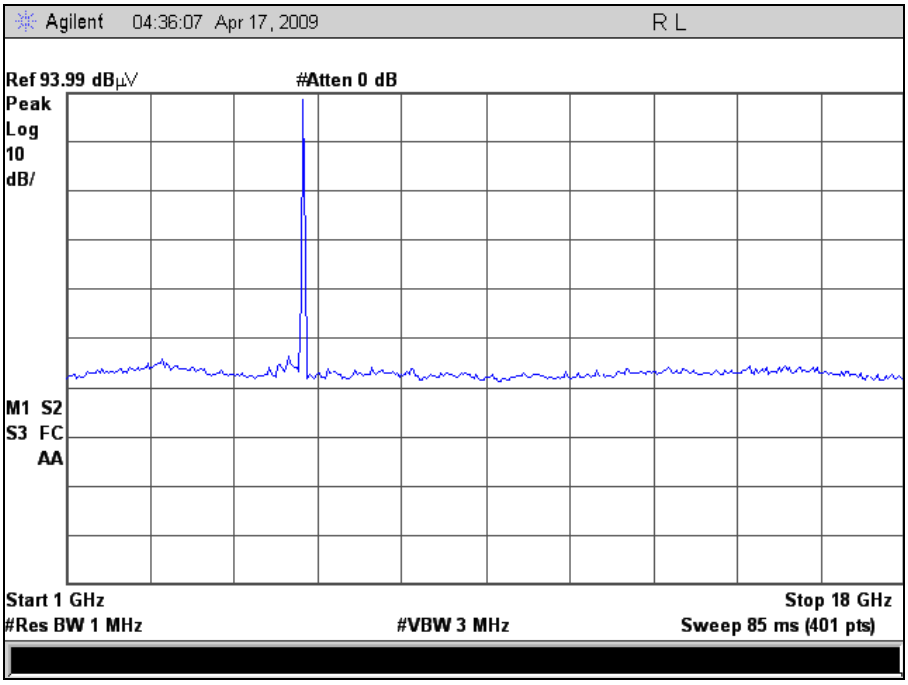
Note: All other emissions were measured at the noise floor of the spectrum analyzer

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Harmonic Emissions Requirements – Radiated (802.11a)

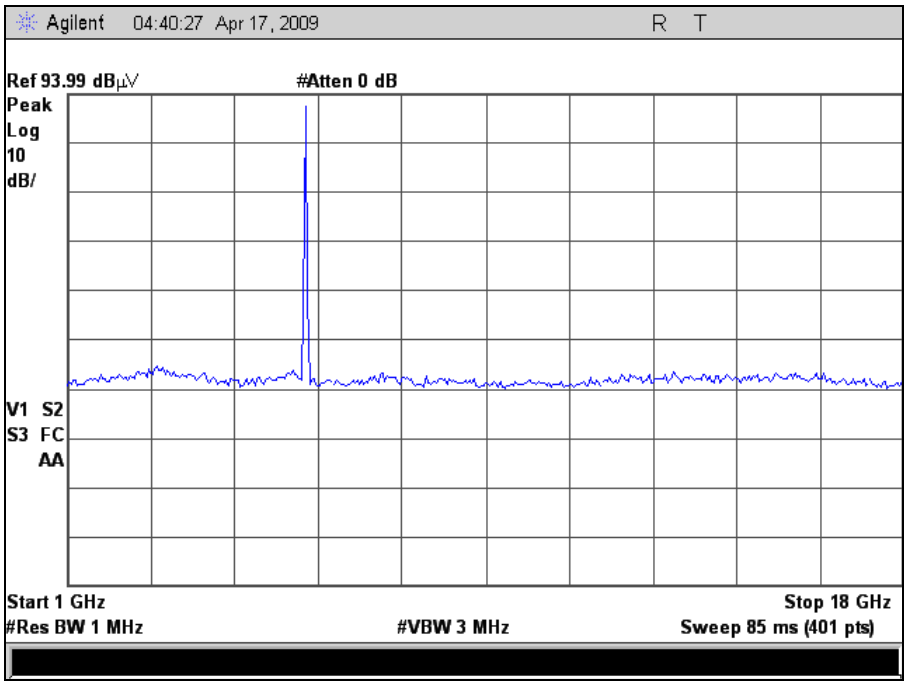


Plot 19. 802.11a Low Channel (chn 149), 1-18GHz



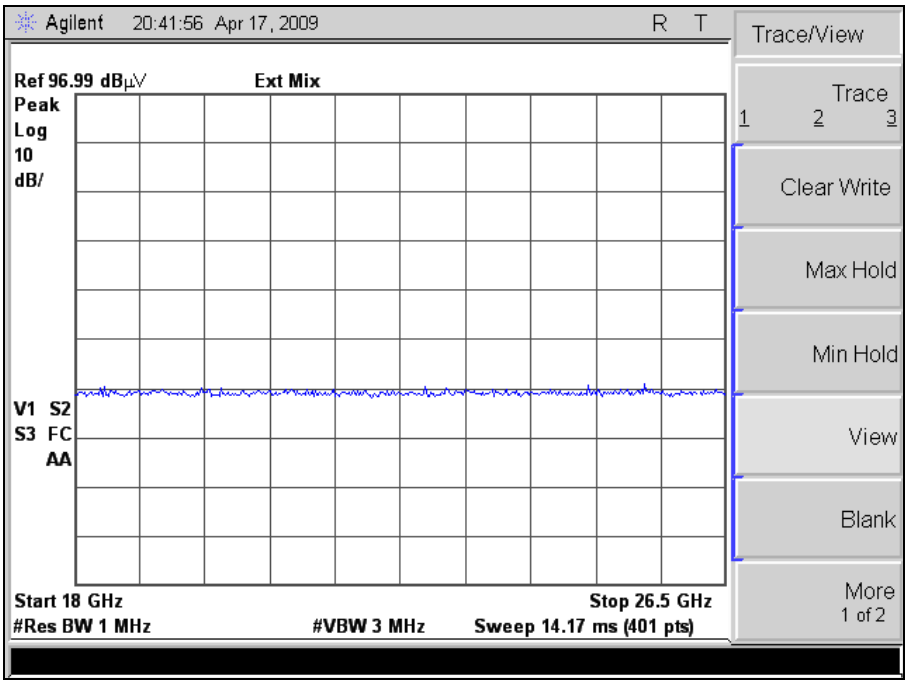
Plot 20. 802.11a Mid Channel (chn 157), 1-18GHz

Electromagnetic Compatibility Criteria for Intentional Radiators

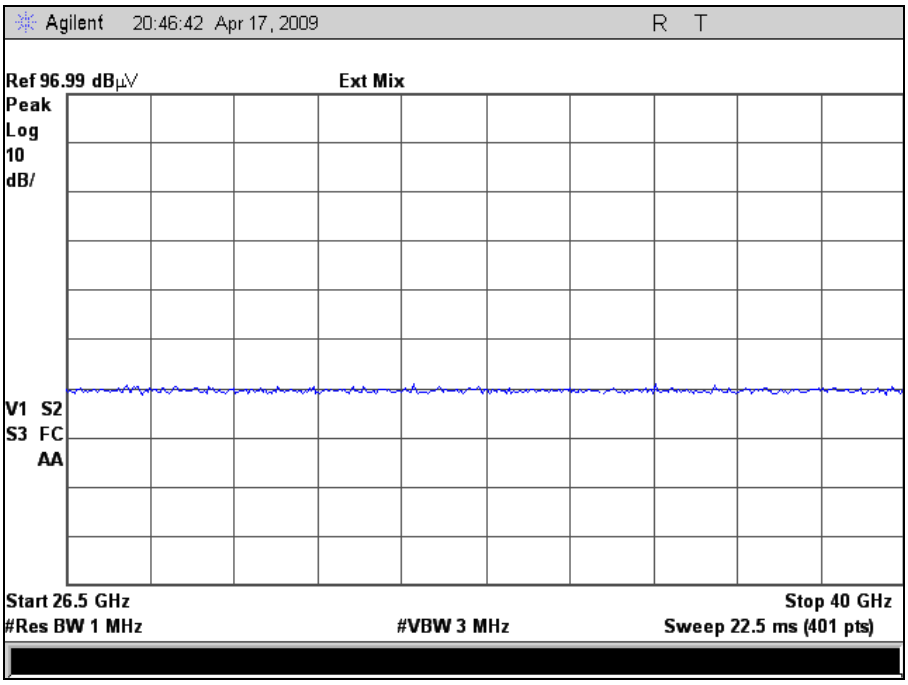


Plot 21. 802.11a High Channel (chn 165), 1-18GHz

§ 15.247(d) Harmonic Emissions Requirements – Radiated (802.11a)



Plot 22. 802.11a Mid Channel, 18-26.5GHz

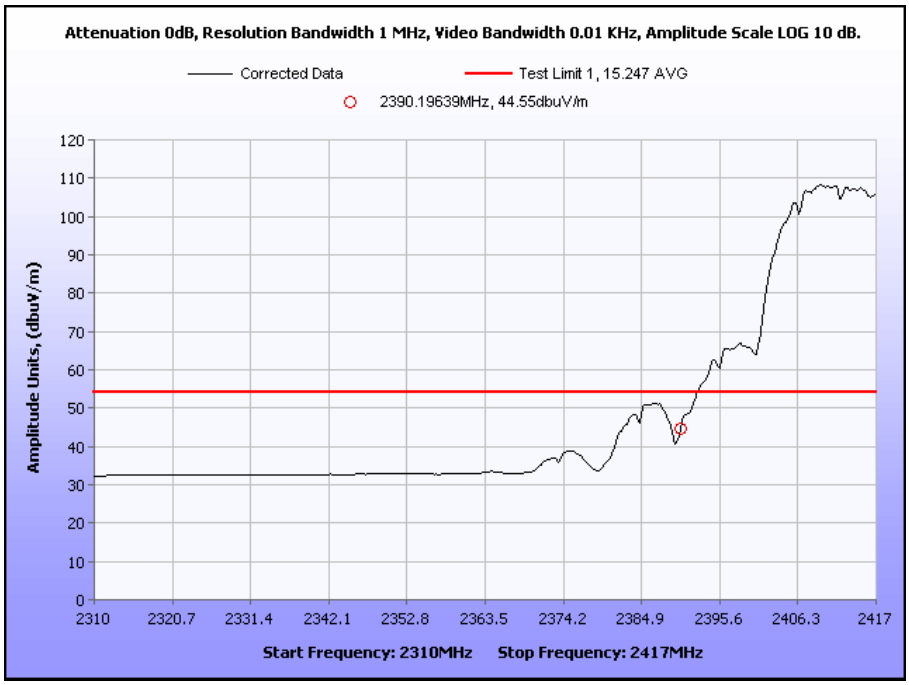


Plot 23. 802.11a Mid Channel, 26.5-40GHz

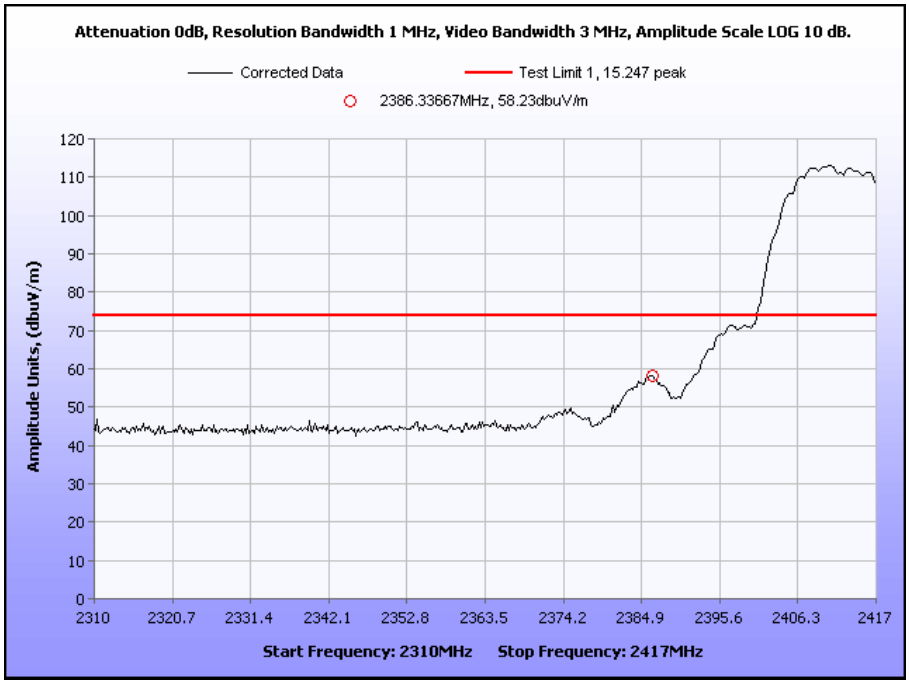
Note: only mid channel has been shown for above 18 GHz since other channels showed similar results.

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Restricted Band Edge – Radiated (802.11b)



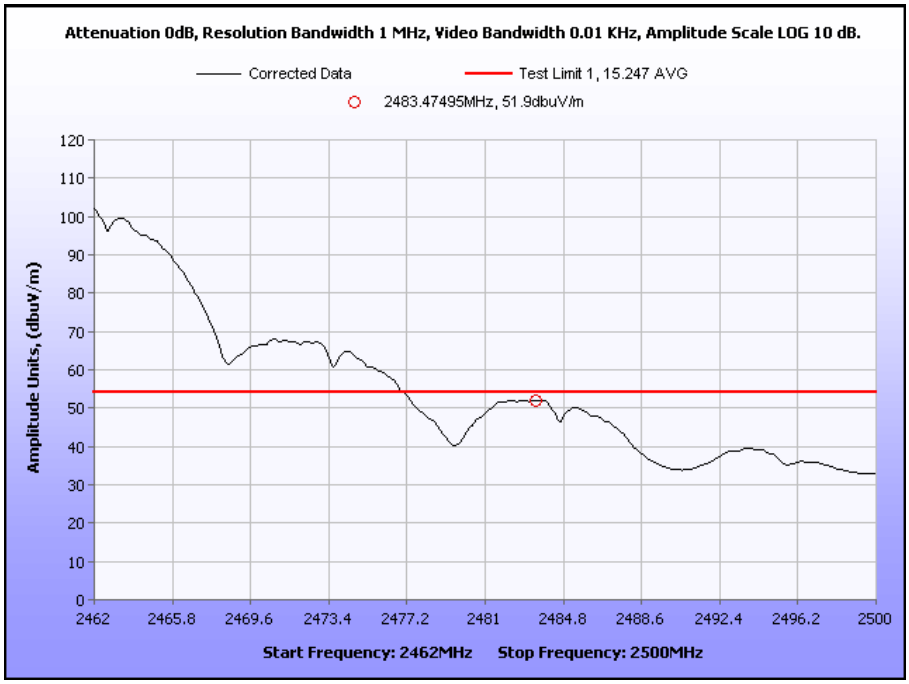
Plot 24. 2.4GHz Channel 1 Band Edge – Avg (b mode)



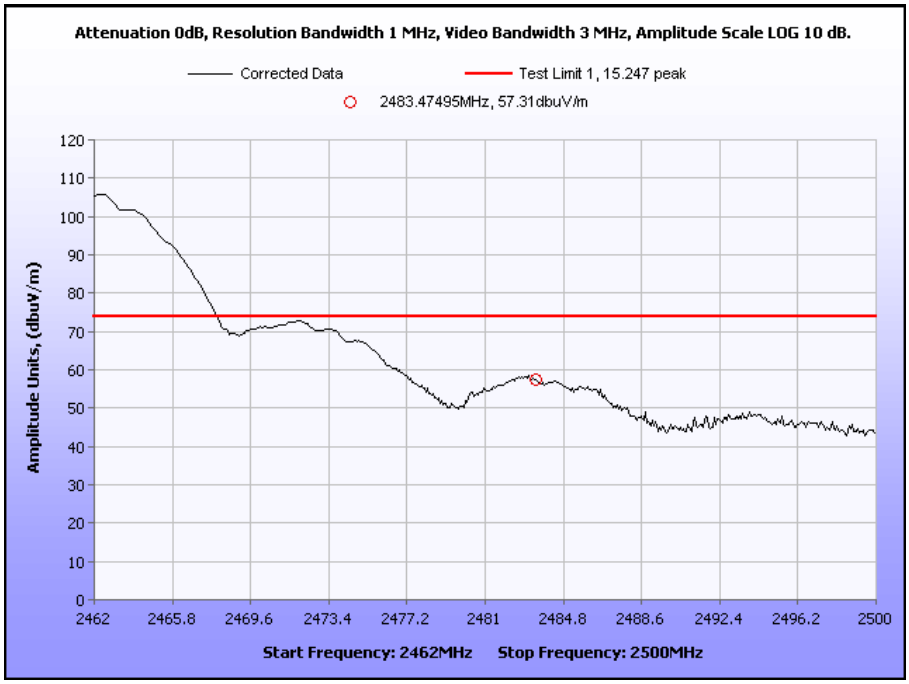
Plot 25. 2.4GHz Channel 1 Band Edge – Peak (b mode)

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Restricted Band Edge – Radiated (802.11b)



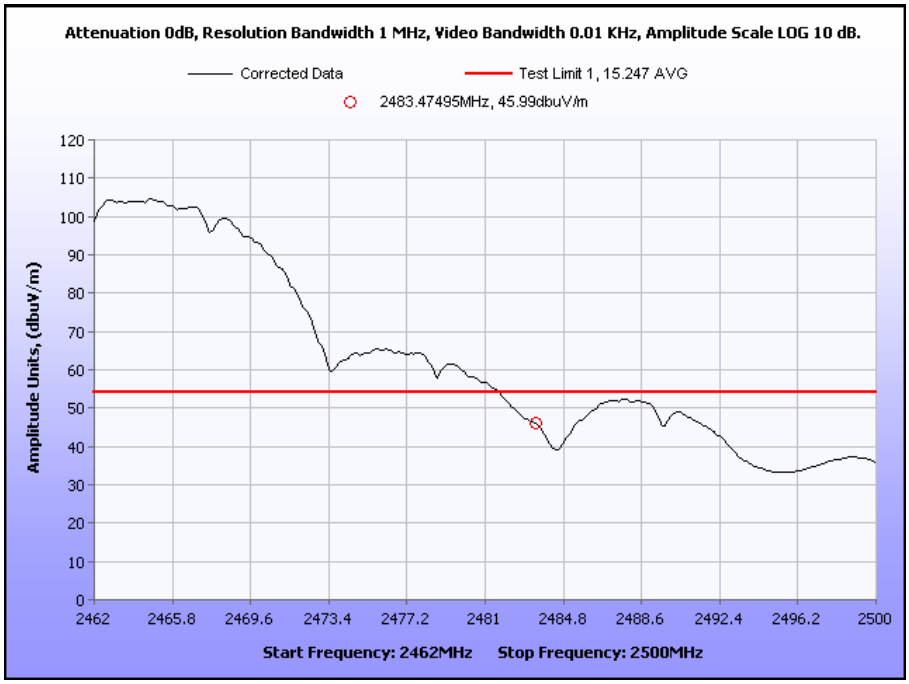
Plot 26. 2.4GHz Channel 10 Band Edge – Avg (b mode)



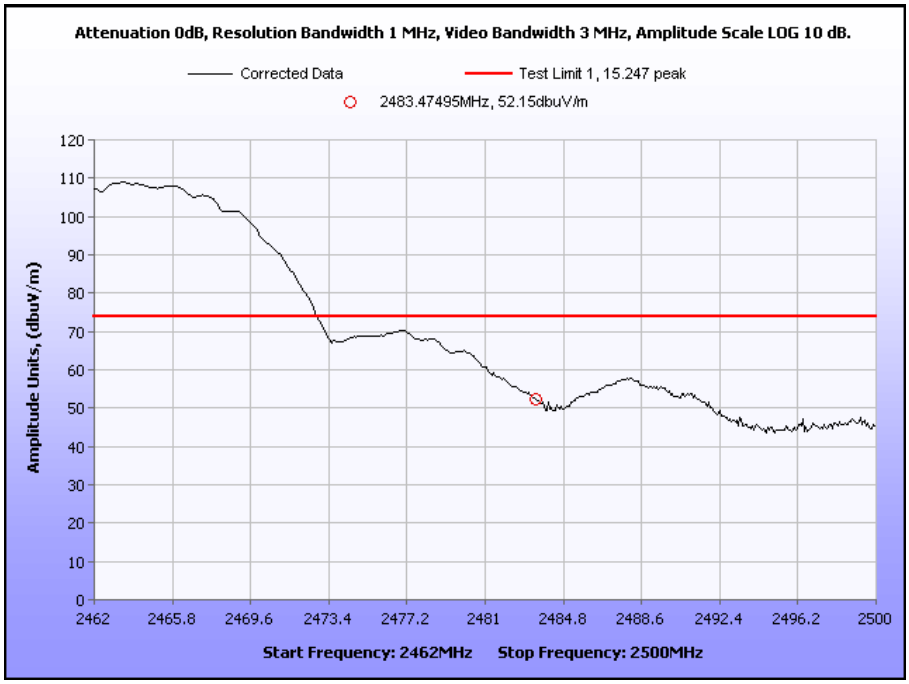
Plot 27. 2.4GHz Channel 10 Band Edge – Peak (b mode)

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Restricted Band Edge – Radiated (802.11b)



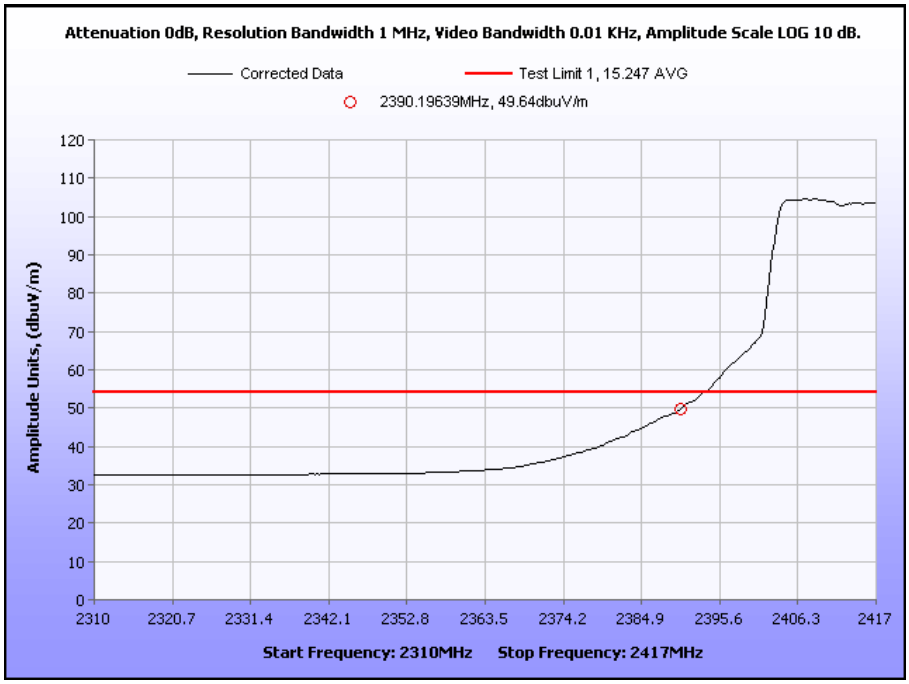
Plot 28. 2.4GHz Channel 11 Band Edge – Avg (b mode)



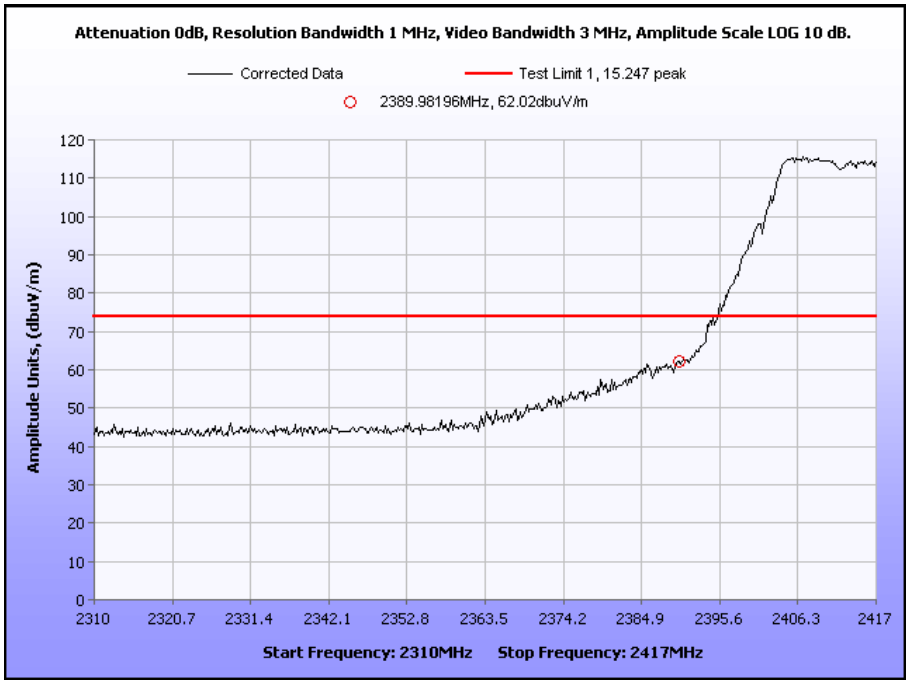
Plot 29. 2.4GHz Channel 11 Band Edge – Peak (b mode)

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Restricted Band Edge – Radiated (802.11g)



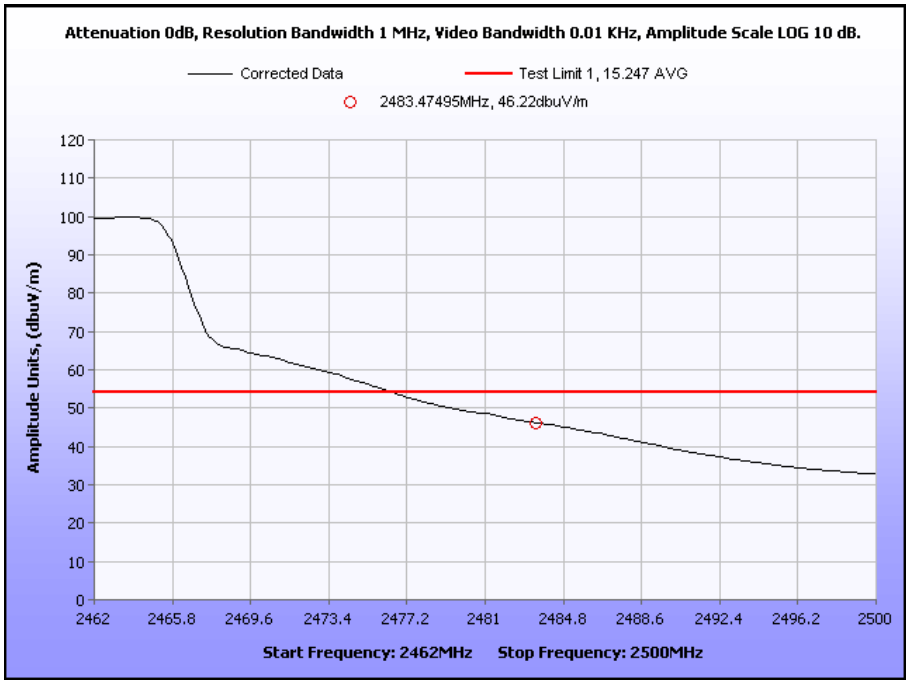
Plot 30. 2.4GHz Channel 1 Band Edge – Avg (g mode)



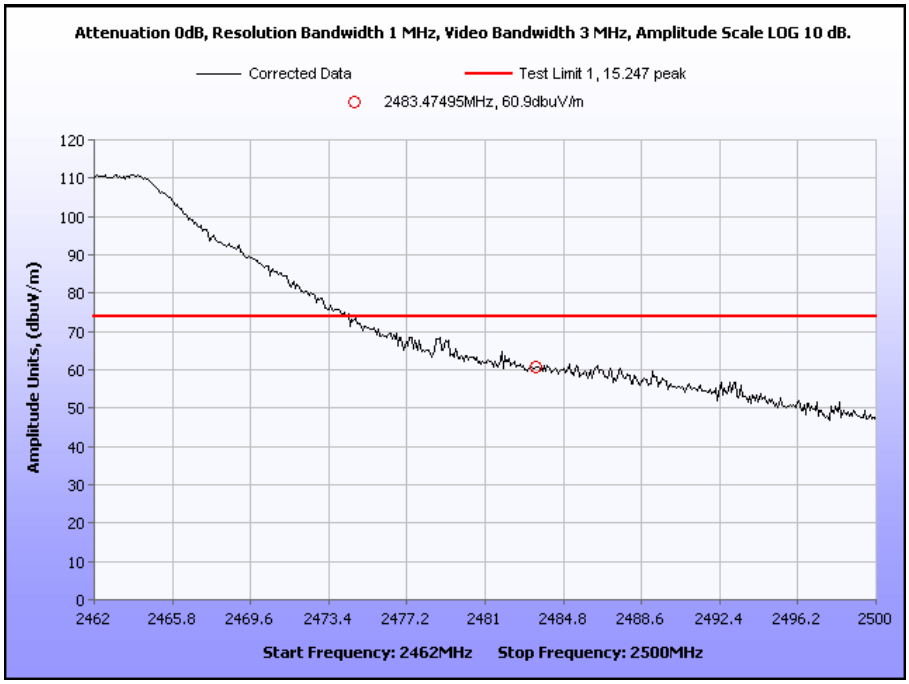
Plot 31. 2.4GHz Channel 1 Band Edge – Peak (g mode)

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Restricted Band Edge – Radiated (802.11b)



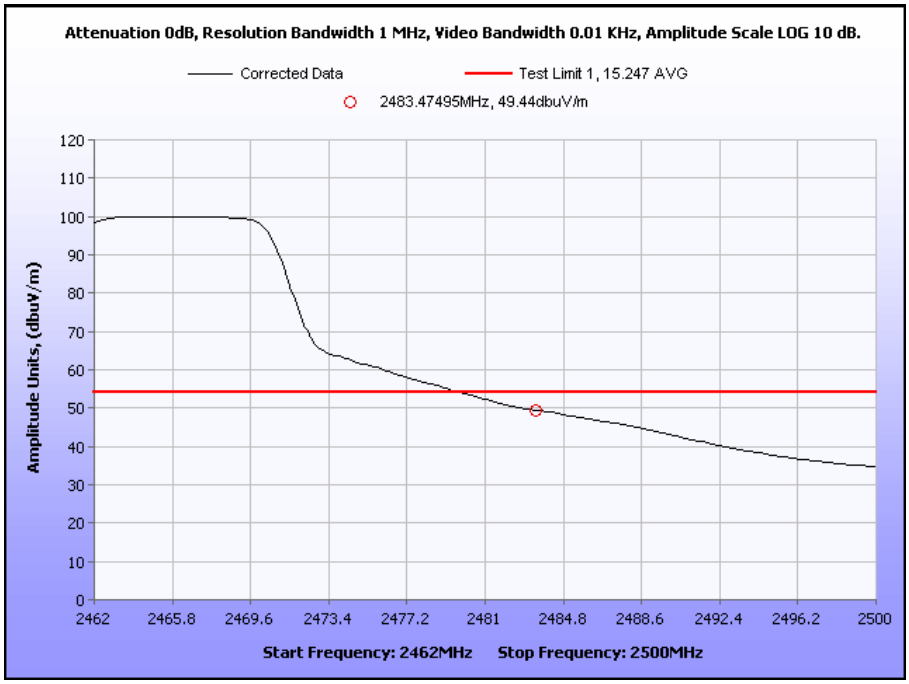
Plot 32. 2.4GHz Channel 10 Band Edge – Avg (g mode)



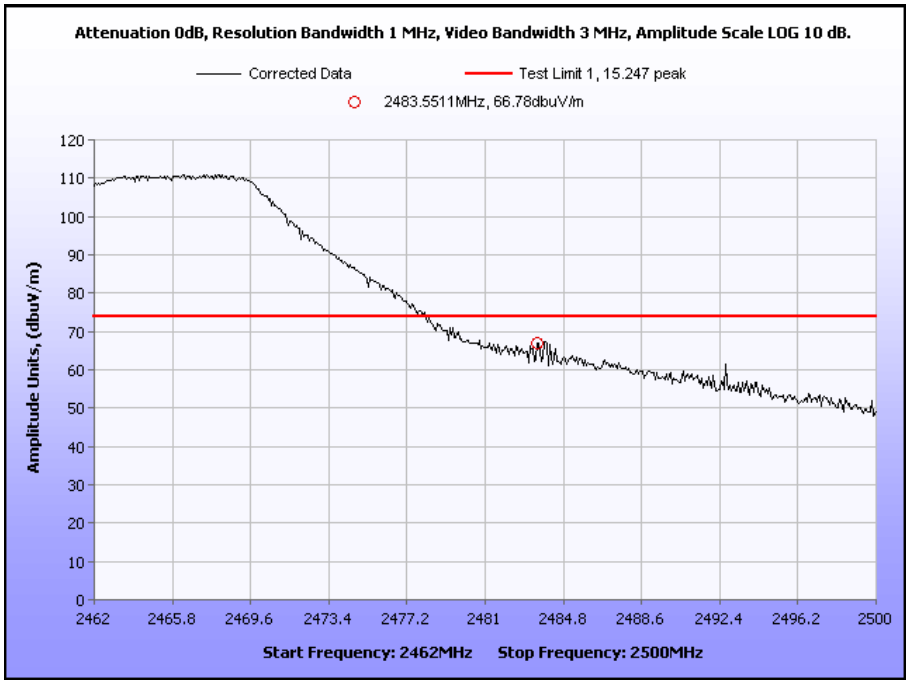
Plot 33. 2.4GHz Channel 10 Band Edge – Peak (g mode)

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Restricted Band Edge – Radiated (802.11b)



Plot 34. 2.4GHz Channel 11 Band Edge – Avg (g mode)



Plot 35. 2.4GHz Channel 11 Band Edge – Peak (g mode)

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Spurious Emissions Requirements –RF Conducted

Test Results: Equipment complies with the Spurious Emissions Requirements – Radiated and RF Conducted limits of **§ 15.247 (d)**. For Radiated Emissions result, refer to section "§15.209: Radiated Emission Limits". Please refer to FCC IDs: SWX-XR2, SWX-XR5 & SWX-XR9 for detailed test results with RF Conducted Spurious Emissions and §15.205.

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 Results: Equipment complies with the peak power spectral density limits of **§ 15.247 (e)**. Please refer to FCC IDs: SWX-XR2, SWX-XR5 & SWX-XR9 for the peak power spectral density results.

IV. Test Equipment

Test Equipment

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

MET #	Equipment	Manufacturer	Model	Cal Date	Cal Due
1T4568	RADIATING NOISE SOURCE	MET LABORATORIES	N/A	SEE NOTE	
1T4632	THERMO/HYGROMETER	CONTROL COMPANY	S6-627-9	09/25/2007	09/25/2009
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	04/18/2008	04/18/2009
1T4300	SEMI-ANECHOIC CHAMBER # 1	EMC TEST SYSTEMS	NONE	02/17/2006	05/22/2009
1T4303	ANTENNA; BILOG	SCHAFNER - CHASE EMC	CBL6140A	07/07/2008	07/07/2009
1T4214	SHIELD ROOM #4	UNIVERSAL SHIELD INC	N/A	SEE NOTE	
1T2947	LISN	SOLAR	8028-50-TS-24-BNC	11/10/2008	11/10/2009
1T2948	LISN	SOLAR	8028-50-TS-24-BNC	11/10/2008	11/10/2009
1T4502	COMB GENERATOR	COM-POWER	CGC-255	09/08/2008	09/08/2009
1T4688	HORN ANTENNA	CUSTOMER MICROWAVE, INC.	HO42S	SEE NOTE	

Table 28. Unintentional Radiator Test Equipment List

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

MET #	Equipment	Manufacturer	Model	Last Cal	Cal Due
1T4300	SEMI-ANECHOIC CHAMBER # 1	EMC TEST SYSTEMS	NONE	02/17/2006	05/22/2009
1T2511	ANTENNA; HORN	EMCO	3115	07/29/2008	07/29/2009
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	04/18/2008	04/20/2009
1T4612	ESA-E SERIES SPECTRUM ANALYZER	AGILENT	E4407B	02/17/2009	02/17/2010
1T4442	PRE-AMPLIFIER, MICROWAVE	MITEQ	AFS42-01001800-30-10P	SEE NOTE	
1T4592	RF FILTER KIT	VARIOUS	N/A	SEE NOTE	
1T4688	HORN ANTENNA	CUSTOMER MICROWAVE, INC.	HO42S	SEE NOTE	

Table 29. Intentional Radiator Test Equipment List

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

V. Certification & User's Manual Information

Certification & User's Manual Information

A. Certification Information

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

§ 2.801 Radio-frequency device defined.

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

(a) The various types of radio communication transmitting devices described throughout this chapter.

(b) The incidental, unintentional and intentional radiators defined in Part 15 of this chapter.

(c) The industrial, scientific, and medical equipment described in Part 18 of this chapter.

(d) Any part or component thereof which in use emits radio-frequency energy by radiation, conduction, or other means.

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

(a) Except as provided elsewhere in this chapter, no person shall sell or lease, or offer for sale or lease (including advertising for sale or lease), or import, ship or distribute for the purpose of selling or leasing or offering for sale or lease, any radio frequency device unless:

(1) In the case of a device subject to certification, such device has been authorized by the Commission in accordance with the rules in this chapter and is properly identified and labeled as required by §2.925 and other relevant sections in this chapter; or

(2) In the case of a device that is not required to have a grant of equipment authorization issued by the Commission, but which must comply with the specified technical standards prior to use, such device also complies with all applicable administrative (including verification of the equipment or authorization under a Declaration of Conformity, where required), technical, labeling and identification requirements specified in this chapter.

(d) Notwithstanding the provisions of paragraph (a) of this section, the offer for sale solely to business, commercial, industrial, scientific or medical users (but not an offer for sale to other parties or to end users located in a residential environment) of a radio frequency device that is in the conceptual, developmental, design or pre-production stage is permitted prior to equipment authorization or, for devices not subject to the equipment authorization requirements, prior to a determination of compliance with the applicable technical requirements *provided* that the prospective buyer is advised in writing at the time of the offer for sale that the equipment is subject to the FCC rules and that the equipment will comply with the appropriate rules before delivery to the buyer or to centers of distribution.

(e)(1) Notwithstanding the provisions of paragraph (a) of this section, prior to equipment authorization or determination of compliance with the applicable technical requirements any radio frequency device may be operated, but not marketed, for the following purposes and under the following conditions:

(i) Compliance testing;

(ii) Demonstrations at a trade show provided the notice contained in paragraph (c) of this section is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iii) Demonstrations at an exhibition conducted at a business, commercial, industrial, scientific or medical location, but excluding locations in a residential environment, provided the notice contained in paragraphs (c) or (d) of this section, as appropriate, is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iv) Evaluation of product performance and determination of customer acceptability, provided such operation takes place at the manufacturer's facilities during developmental, design or pre-production states; or

(v) Evaluation of product performance and determination of customer acceptability where customer acceptability of a radio frequency device cannot be determined at the manufacturer's facilities because of size or unique capability of the device, provided the device is operated at a business, commercial, industrial, scientific or medical user's site, but not at a residential site, during the development, design or pre-production stages.

(e)(2) For the purpose of paragraphs (e)(1)(iv) and (e)(1)(v) of this section, the term *manufacturer's facilities* includes the facilities of the party responsible for compliance with the regulations and the manufacturer's premises, as well as the facilities of other entities working under the authorization of the responsible party in connection with the development and manufacture, but not the marketing, of the equipment.

(f) For radio frequency devices subject to verification and sold solely to business, commercial, industrial, scientific and medical users (excluding products sold to other parties or for operation in a residential environment), parties responsible for verification of the devices shall have the option of ensuring compliance with the applicable technical specifications of this chapter at each end user's location after installation, provided that the purchase or lease agreement includes a proviso that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.

Certification & User's Manual Information

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

§ 2.901 Basis and Purpose

(a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service wherein the equipment is to be operated.[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

Label and User's Manual Information

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

§ 15.19 Labeling requirements.

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

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

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

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

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

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

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

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

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

§ 15.21 Information to user.

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

Verification & User's Manual Information

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

§ 15.105 Information to the user.

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

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

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

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

– Reorient or relocate the receiving antenna.

– Increase the separation between the equipment and receiver.

– Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

– Consult the dealer or an experienced radio/TV technician for help.

ICES-003 Procedural & Labeling Requirements

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

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

Procedural Requirements:

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

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

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

Labeling Requirements:

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

> This Class [2] digital apparatus complies with Canadian ICES-003.
>
> Cet appareil numérique de la classe [1] est conforme à la norme NMB-003 du Canada.

[2] Insert either A or B but not both as appropriate for the equipment requirements.

End of Report

