MET Laboratories, Inc. ***Safety Certification - EMI - Telecom Environmental Simulation***
914 WEST PATAPSCO AVENUE ● BALTIMORE, MARYLAND 21230-3432 ● PHONE (410) 354-3300 ● FAX (410) 354-3313

June 20, 2012

CleanAlert, LLC
27 1/2 East College St., Ste. #2
Oberlin, OH 44074

Dear Bill Sherman,

Enclosed is the EMC Wireless test report for compliance testing of the CleanAlert, LLC, FS-242-BW as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), FCC Part 15 Subpart B, ICES-003, Issue 4 February 2004 for a Class B Digital Device and FCC Part 15 Subpart C, RSS-210, Issue 8, Dec. 2010 for Intentional Radiators.

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

Sincerely yours,
MET LABORATORIES, INC.

Jennifer Warnell
Documentation Department

Reference: (\CleanAlert, LLC\EMC34311B-FCC231 Rev. 1)

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Electromagnetic Compatibility Criteria Test Report

for the

CleanAlert, LLC
FS-242-BW

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Parts 15 Subpart B & ICES-003
for Class B Digital Devices
&
15.247 Subpart C & RSS-210, Issue 8, Dec. 2010
for Intentional Radiators

MET Report: EMC34311B-FCC231 Rev. 1

June 20, 2012

Prepared For:

CleanAlert, LLC
27 ½ East College St., Ste. #2
Oberlin, OH 44074

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

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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 FCC Rules Parts 15B, 15.231 and Industry Canada standards ICES-003, Issue 4 February 2004, RSS-210, Issue 8, Dec. 2010 under normal use and maintenance.

Shawn McMillen
Wireless Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	May 25, 2012	Initial Issue.
1	June 20, 2012	Revised to reflect customer corrections.

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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
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**ert**z**
kHz	**k**ilo**h**ert**z**
kPa	**k**ilo**pa**scal
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µ**H**	**microh**enry
µ	**microf**arad
µ**s**	**micros**econds
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 CleanAlert, LLC FS-242-BW, with the requirements of Part 15, §15.231. 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 FS-242-BW. CleanAlert, LLC should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the FS-242-BW, 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, §15.231, in accordance with CleanAlert, LLC, purchase order number 2012013102. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference	IC Reference	Description	Results
Unintentional Digital			
§15.107	ICES-003 Issue 4 February 2004	AC Power Line Conducted Emissions	Compliant
§15.109	ICES-003 Issue 4 February 2004	Radiated Emissions	Compliant
Transmitter Mode (TX)			
§15.203	N/A	Antenna Requirement	Compliant
§15.207	RSS-GEN (7.2.4)	AC Power Line Conducted Emissions	Compliant
§15.231(a)	RSS-210 (A.1.1.5)	Periodic Operation Requirements	Compliant
§15.231(e)	RSS-210(A1.1)	Field Strength of Fundamentals and Harmonics	Compliant
§15.231(c)	RSS-210 (A1.1.3)	20dB and 99% Bandwidth	Compliant

Table 1. Executive Summary of EMC Part 15.231 ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by CleanAlert, LLC to perform testing on the FS-242-BW, under CleanAlert, LLC's purchase order number 2012013102.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the CleanAlert, LLC, FS-242-BW.

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

Model(s) Tested:	FS-242-BW	
EUT Specifications:	Primary Power: 6 VDC from 4 AA batteries	
	FCC ID: AUPFS-242 IC: 10341A-FS242	
	Max Field Strength:	71.25 dBuV/m @ 3m
	EUT Frequency Ranges:	418 MHz
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature: 15-35º C	
	Relative Humidity: 30-60%	
	Barometric Pressure: 860-1060 mbar	
Evaluated by:	Len Knight	
Report Date(s):	June 20, 2012	

Table 2. EUT Summary Table

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
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

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

D. Description of Test Sample

The CleanAlert, LLC, model FS-242-BW, is as follows:

The FILTERSCAN® tracks the increase in differential pressure across an air filter to monitor filter clogging. The FILTERSCAN® provides visual and audible alerts indicating that a filter needs to be serviced when the increase in differential pressure reaches a specified level. When connected to a remote device, the FILTERSCAN® also provides a 5 VDC output indicating when a filter needs to be serviced. An optional wireless model of the FILTERSCAN® with a wall-mounted receiver is also available.

E. Mode of Operation

The EUT was operated under accelerated timing and normal conditions during testing. The transmission timing was extended to simplify RF power output measurement for part of the test. Then, the transmission timing was reset to an acceptable format per FCC rules, being a burst of one (1) second on, one (1) second off, one (1) second on, one (1) second off, one (1) second on, yielding a five-second transmission time, repeated every 30 minutes to indicate Monitor status at the Receiver. Monitor error conditions were simulated by creating airflow through the sensor tube of the Monitor.

For the purposes of certification, the model FS-242-BW, which can be operated from either a battery source or an AC/DC converter was tested.

F. 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.

G. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to CleanAlert, LLC 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 4. 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 4. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

Frequency range (MHz)	Class A Conducted Limits (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.				

Table 4. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Subsections 15.107(a) (b)

Test Procedures:

The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber. The method of testing, test conditions, and test procedures of ANSI C63.4 were used. The EUT was powered through a 50Ω/50µH 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 Class B requirement(s) of this section. Measured emissions were below applicable limits.

Test Engineer(s):

Ben Taylor

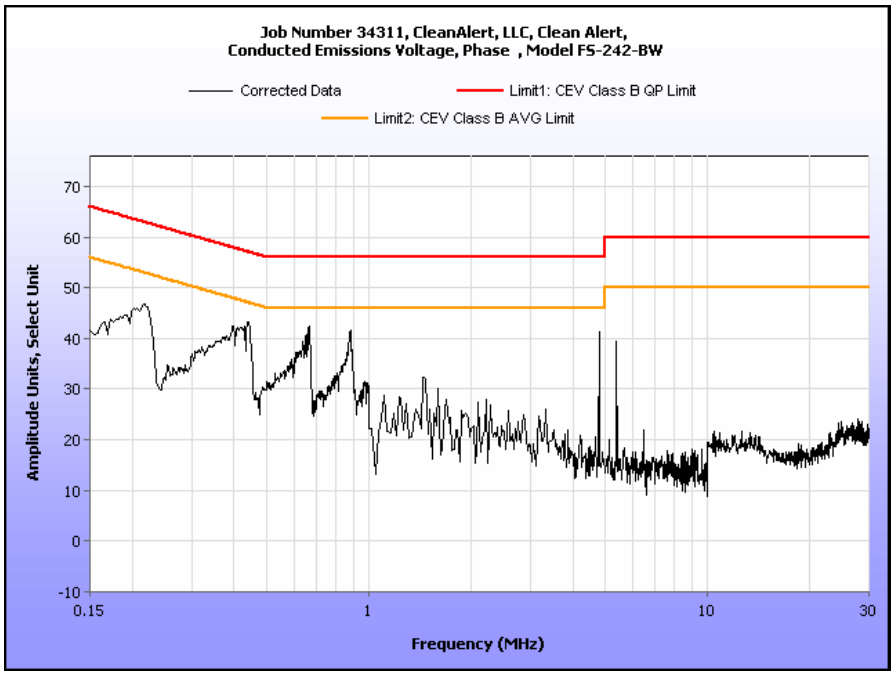
Test Date(s):

02/17/12

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
0.22	39.55	0.02	39.57	62.82	-23.25	22.37	0.02	22.39	52.82	-30.43
0.434	33.84	0.03	33.87	57.18	-23.31	18.88	0.03	18.91	47.18	-28.27
0.664	34.39	0.04	34.43	56	-21.57	16.8	0.04	16.84	46	-29.16
0.8862	34.29	0.06	34.35	56	-21.65	16	0.06	16.06	46	-29.94
4.8	47.53	0.28	47.81	56	-8.19	36.38	0.28	36.66	46	-9.34
5.383	51.24	0.33	51.57	60	-8.43	31.28	0.33	31.61	50	-18.39

Table 5. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz)

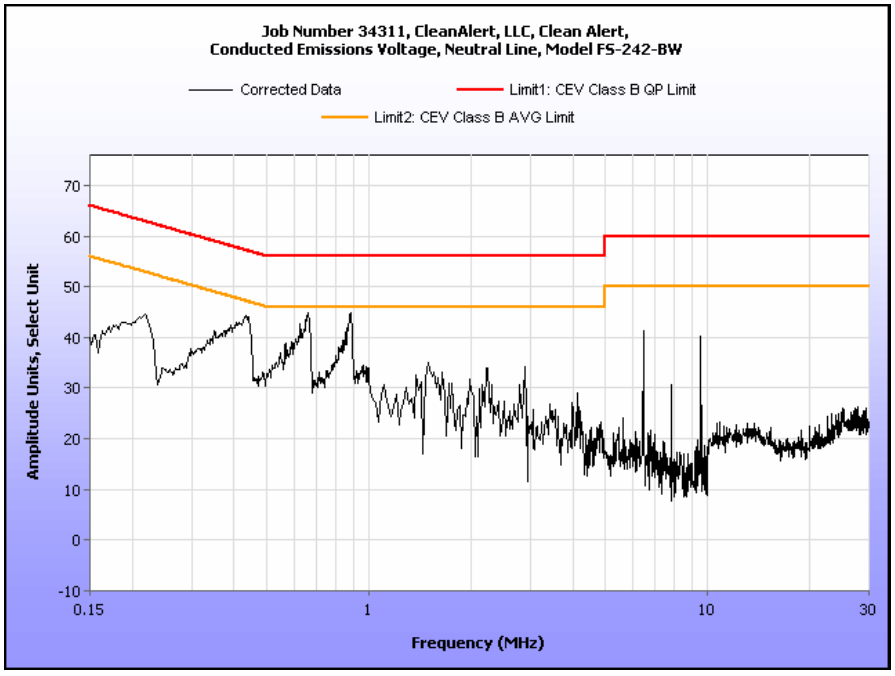


Plot 1. Conducted Emission, Phase Line Plot

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
0.221	39.81	0.03	39.84	62.78	-22.94	24.2	0.03	24.23	52.78	-28.55
0.4375	39.27	0.03	39.3	57.11	-17.81	21.37	0.03	21.4	47.11	-25.71
0.6625	39.63	0.04	39.67	56	-16.33	21.51	0.04	21.55	46	-24.45
0.874	41.27	0.06	41.33	56	-14.67	25.88	0.06	25.94	46	-20.06
6.46	51.04	0.32	51.36	60	-8.64	32.4	0.32	32.72	50	-17.28
9.555	43.29	0.39	43.68	60	-16.32	19.66	0.39	20.05	50	-29.95

Table 6. Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz)



Plot 2. Conducted Emission, Neutral Line Plot

Conducted Emission Limits Test Setup

Photograph 1. Conducted Emissions, Test Setup

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 7.

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 7.

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

Table 7. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b)

Test Procedures: The EUT was placed on a 0.8m-high non-conductive table inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.4 were used. An antenna was located 3 m from the EUT on an adjustable mast. A pre-scan was performed in order to find prominent radiated emissions. For emissions measurements, the EUT was rotated and the antenna height was varied between 1 m and 4 m in order to maximize the emissions. Measurements in both horizontal and vertical polarities were made and the data was recorded.

Test Results: The EUT was found to comply with the Class B requirement(s) of this section.

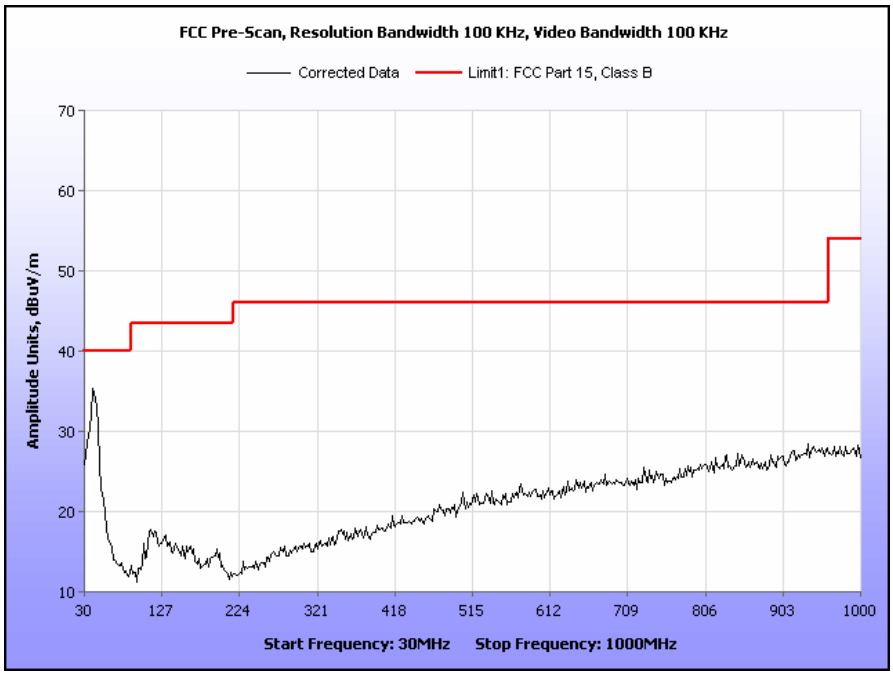
Test Engineer(s): Len Knight

Test Date(s): 12/20/11

FCC Radiated Emissions Limits Test Results, Class B, AC-DC Converter

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
45.571142	147	H	1.52	5.50	10.86	0.45	0.00	16.81	40.00	-23.19
45.571142	0	V	1.00	19.41	10.86	0.45	0.00	30.72	40.00	-9.28
59.345691	164	H	1.49	5.72	7.50	0.54	0.00	13.76	40.00	-26.24
59.345691	119	V	1.00	11.44	7.50	0.54	0.00	19.48	40.00	-20.52
95.11022	193	H	1.51	17.93	8.83	0.75	0.00	27.51	43.50	-15.99
95.11022	193	V	1.00	14.43	8.83	0.75	0.00	24.01	43.50	-19.49

Table 8. Radiated Emissions, Test Results, AC-DC Converter, FCC Limits

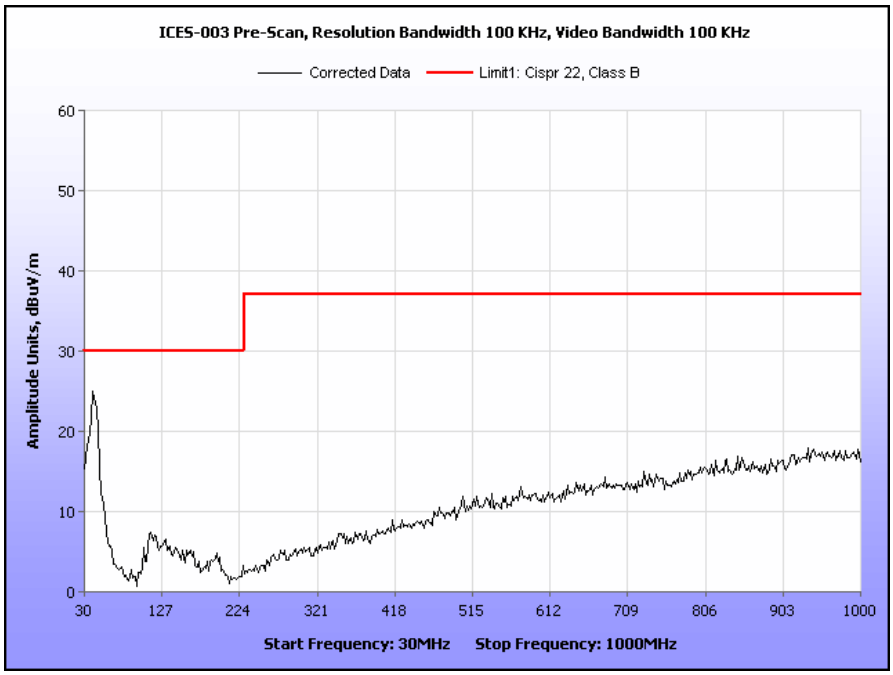


Plot 3. Radiated Emissions, Pre-Scan, AC-DC Converter, FCC Limits

FCC Radiated Emissions Limits Test Results, Class B, AC-DC Converter

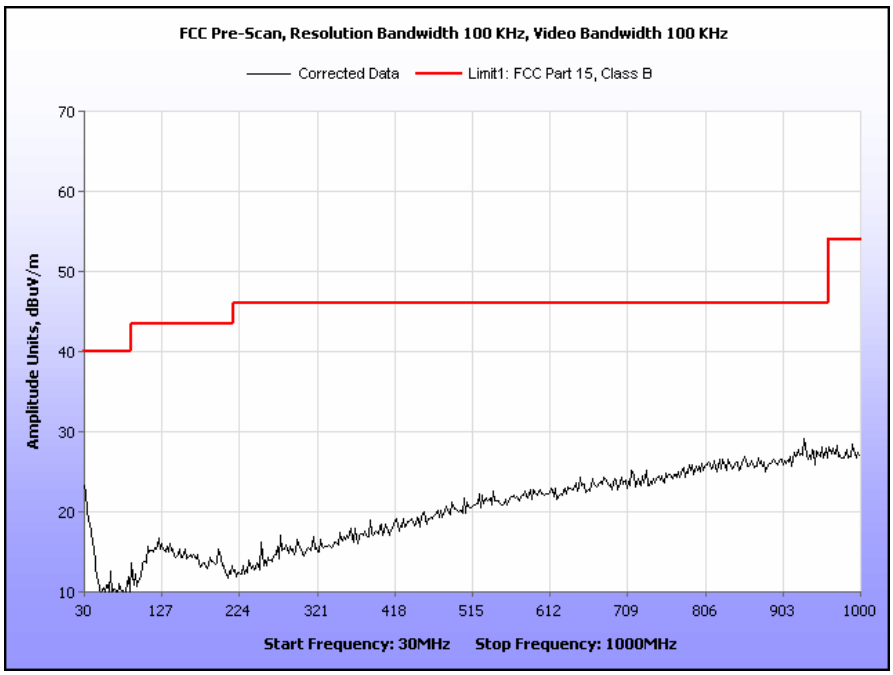
Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
45.571142	147	H	1.52	5.50	10.86	0.45	10.46	6.35	30.00	-23.65
45.571142	0	V	1.00	19.41	10.86	0.45	10.46	20.26	30.00	-9.74
59.345691	164	H	1.49	5.72	7.50	0.54	10.46	3.30	30.00	-26.70
59.345691	119	V	1.00	11.44	7.50	0.54	10.46	9.02	30.00	-20.98
95.11022	193	H	1.51	17.93	8.83	0.75	10.46	17.05	30.00	-12.95
95.11022	193	V	1.00	14.43	8.83	0.75	10.46	13.55	30.00	-16.45

Table 9. Radiated Emissions, Test Results, AC-DC Converter, ICES-003 Limits

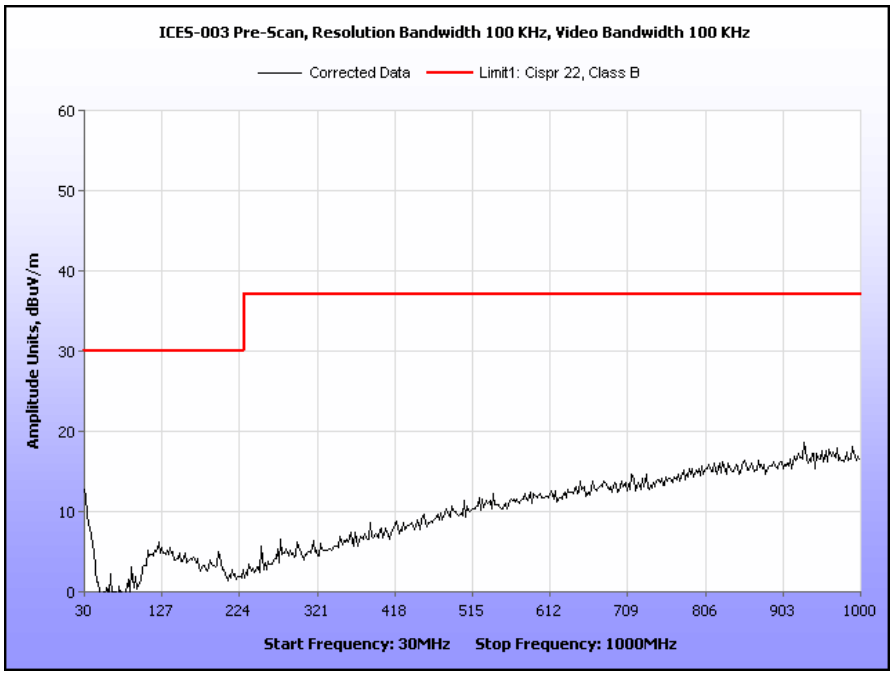


Plot 4. Radiated Emissions, Pre-Scan, AC-DC Converter, FCC Limits

FCC Radiated Emissions Limits Test Results, Class B, Batteries Only

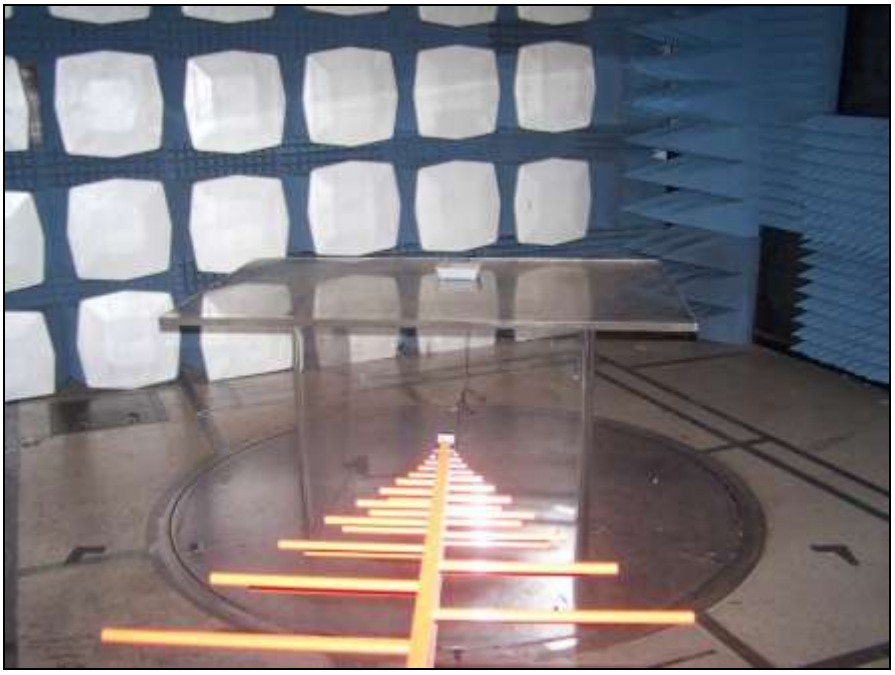


Plot 5. Radiated Emissions, Pre-Scan, Batteries Only, FCC Limits



Plot 6. Radiated Emissions, Pre-Scan, Batteries Only, ICES-003 Limits

Radiated Emission Limits Test Setup



Photograph 2. Radiated Emissions, Test Setup, AC-DC Converter

Photograph 3. Radiated Emissions, Test Results, Batteries Only

IV. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 Antenna Requirement

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

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

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

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

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

Results: The EUT as tested is compliant the criteria of §15.203 by virtue of having an integral antenna.

Test Engineer(s): Len Knight

Test Date(s): 03/05/12

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.207(a) 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 10. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

Test Procedure: The EUT was placed on a 0.8 m-high wooden table inside a screen room. 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. For the purpose of this testing, the transmitter was turned on. Scans were performed with the transmitter on.

Test Results: The EUT was compliant with this requirement.

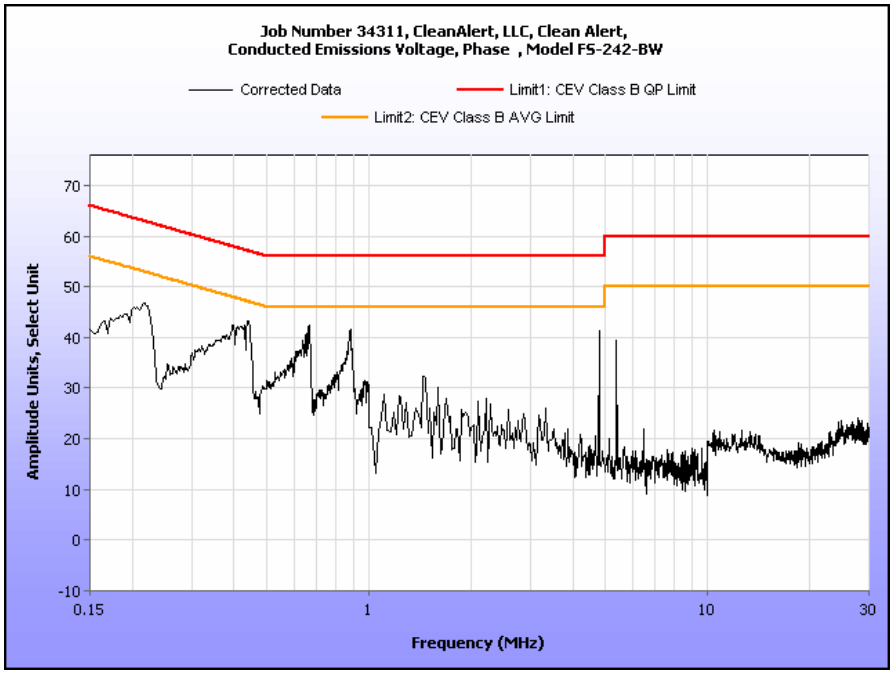
Test Engineer(s): Ben Taylor

Test Date(s): 02/17/12

15.207(a) Conducted Emissions Test Results

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
0.22	39.55	0.02	39.57	62.82	-23.25	22.37	0.02	22.39	52.82	-30.43
0.434	33.84	0.03	33.87	57.18	-23.31	18.88	0.03	18.91	47.18	-28.27
0.664	34.39	0.04	34.43	56	-21.57	16.8	0.04	16.84	46	-29.16
0.8862	34.29	0.06	34.35	56	-21.65	16	0.06	16.06	46	-29.94
4.8	47.53	0.28	47.81	56	-8.19	36.38	0.28	36.66	46	-9.34
5.383	51.24	0.33	51.57	60	-8.43	31.28	0.33	31.61	50	-18.39

Table 11. Conducted Emissions, 15.207(a), Phase Line, Test Results

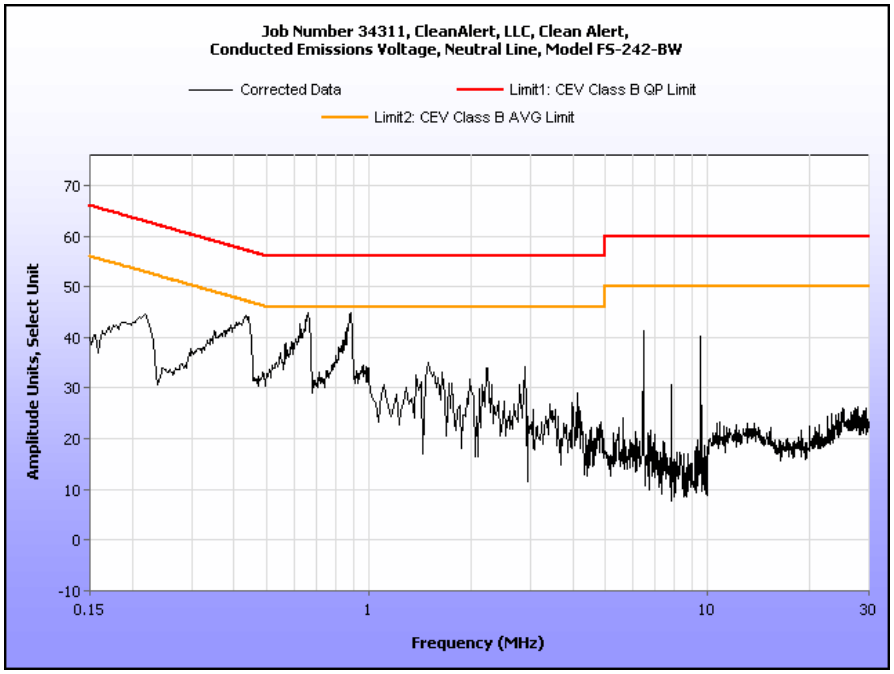


Plot 7. Conducted Emissions, 15.207(a), Phase Line

15.207(a) Conducted Emissions Test Results

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
0.221	39.81	0.03	39.84	62.78	-22.94	24.2	0.03	24.23	52.78	-28.55
0.4375	39.27	0.03	39.3	57.11	-17.81	21.37	0.03	21.4	47.11	-25.71
0.6625	39.63	0.04	39.67	56	-16.33	21.51	0.04	21.55	46	-24.45
0.874	41.27	0.06	41.33	56	-14.67	25.88	0.06	25.94	46	-20.06
6.46	51.04	0.32	51.36	60	-8.64	32.4	0.32	32.72	50	-17.28
9.555	43.29	0.39	43.68	60	-16.32	19.66	0.39	20.05	50	-29.95

Table 12. Conducted Emissions, 15.207(a), Neutral Line, Test Results



Plot 8. Conducted Emissions, 15.207(a), Neutral Line

15.207(a) Conducted Emissions Test Setup Photo

Photograph 4. Conducted Emissions, 15.207(a), Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.231 (a) Periodic Operation Requirements

Test Requirement(s):

§ 15.231 (a): The provisions of this section are restricted to periodic operation within the band 40.66–40.70 MHz and above 70 MHz.

§ 15.231 (e): Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including prohibited in paragraph (a) of this section.

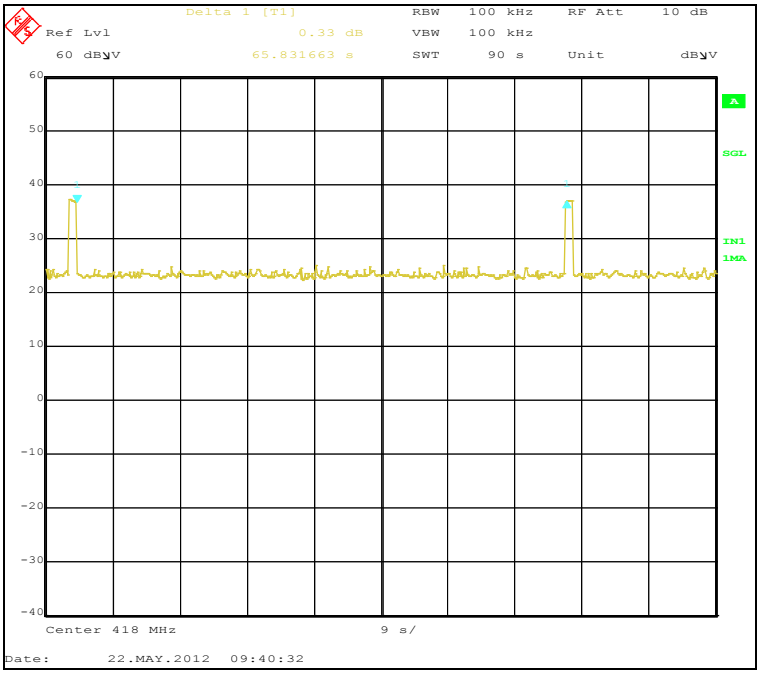
In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

Test Procedure: The EUT transmitter was activated. The spectrum analyzer single sweep was triggered while a command on the EUT was activated and plots were captured.

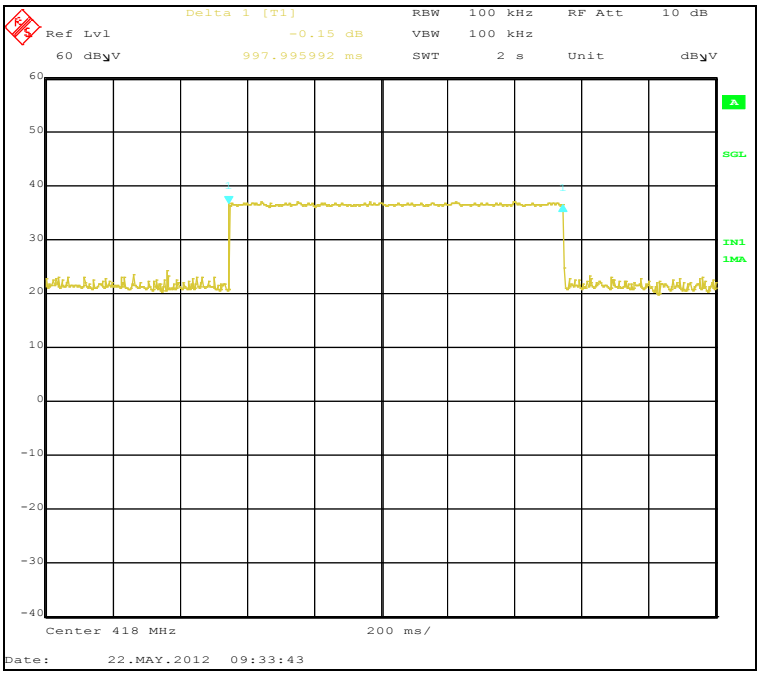
Test Results: The spectrum analyzer plot below shows the transmitter time on and silent period.

Test Engineer(s): Len Knight

Test Date(s): 04/04/12



Plot 9. Periodic Operation, Time Off



Plot 10. Periodic Operation, Time On

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.231(b)(e) Field Strength of Fundamental and Harmonics

Test Requirements: **§15.231(b):** In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/ meter)	Field strength of spurious emissions (microvolts/meter)
40.66– 40.70	2,250	225
70–130	1,250	125
130–174	1,250* to 3,750	125* to 375
174–260	3,750	375
260–470	3,750* to 12,500	375* to 1,250
Above 470	12,500	1,250
Note: * Linear Interpolations		

(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges. (2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section. (3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

§15.231(e): Intentional radiators may operate may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emission (microvolts/meter)
40.66 – 407.70	1,000	100
70 – 130	500	50
130 – 174	500 to 1500[1]	50 to 150[1]
174 – 260	1,500	150
260 – 470	1,500 to 5,000[1]	150 to 500[1]
Above 470	5,000	500

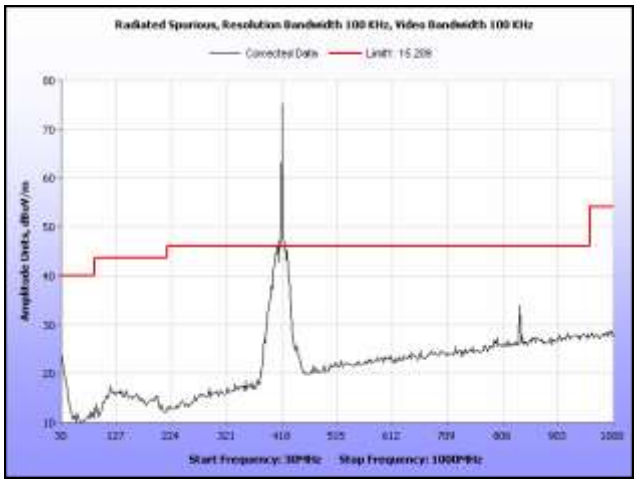
[1]Linear interpolations.

Test Procedure:	The EUT was placed in a 3m semi anechoic chamber. A log periodic antenna was placed 3m from the EUT and used to measure the field strength of the fundamental. The EUT was rotated about all three orthogonal axis. The quasi-peak field strength was measured and recorded. For harmonics measurements above 1 GHz, a horn antenna was used 1m from the EUT. A preamp was used to measure the harmonics. Fresh batteries were used at the time of testing.
Test Results:	Equipment complies with § 15.231 (b).
Test Engineer:	Len Knight
Test Date:	03/22/12

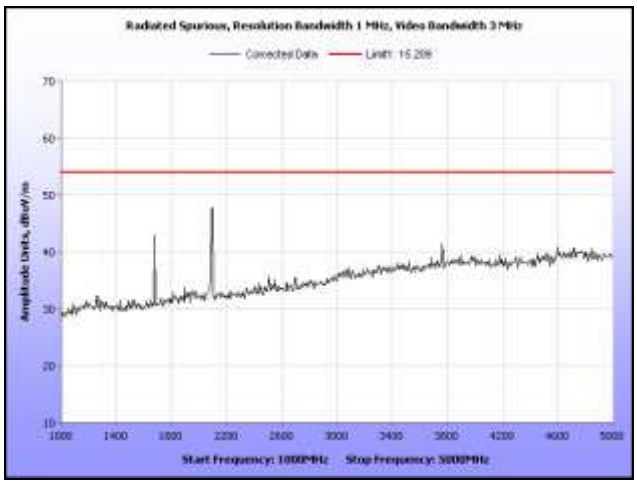
Electromagnetic Compatibility Criteria for Intentional Radiators

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuv)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	D.C.C.F.	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
418	248	H	1.00	53.08	16.56	1.61	0.00	71.25	72.30	-1.05
418	149	V	1.27	50.87	16.56	1.61	0.00	69.04	72.30	-3.26

Table 13. Field Strength of Fundamental, Test Results

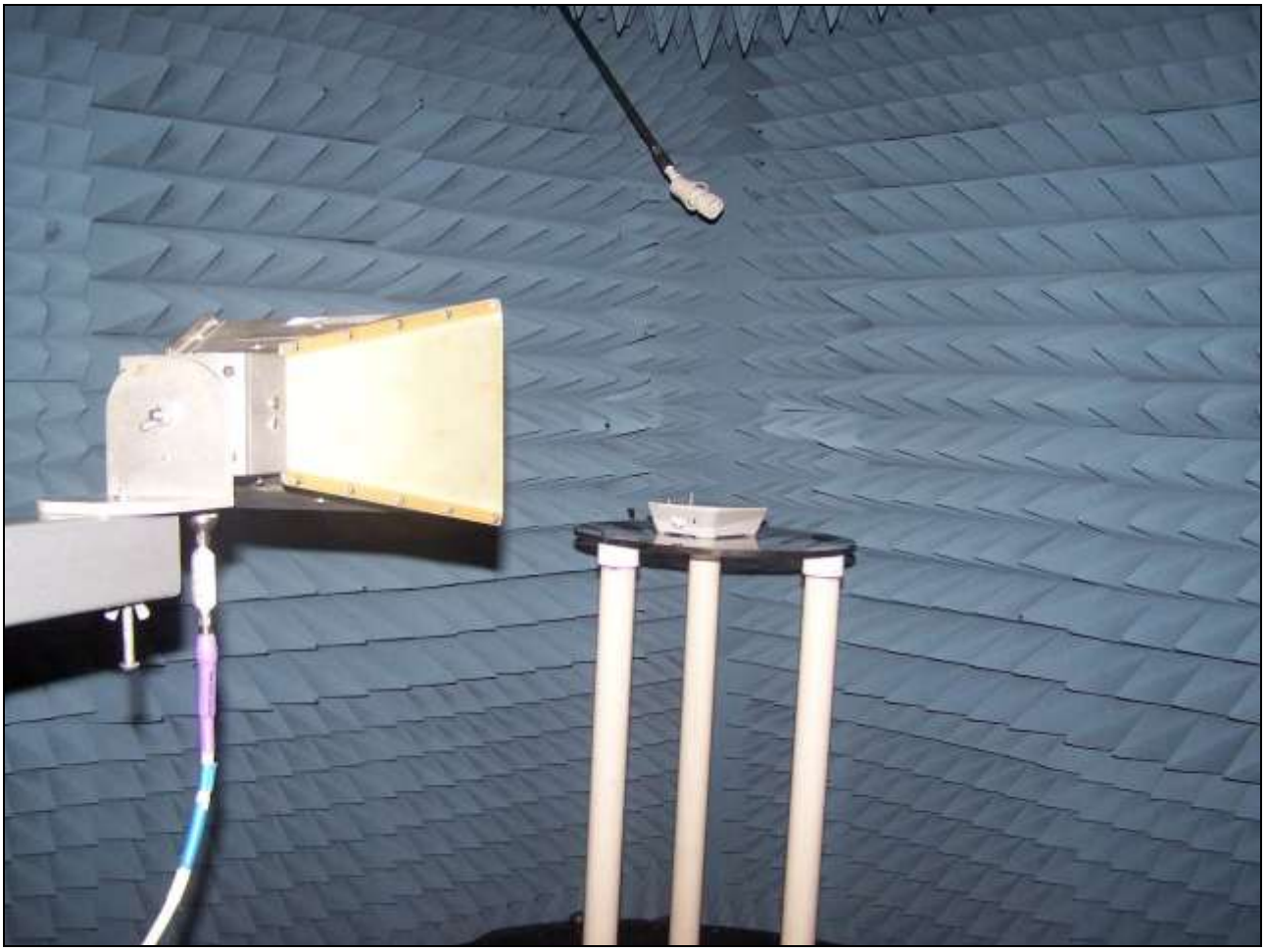


Plot 11. Radiated Spurious Emissions, 30 MHz – 1 GHz



Plot 12. Radiated Spurious Emissions, 1 GHz – 5 GHz

Electromagnetic Compatibility Criteria for Intentional Radiators



Photograph 5. Radiated Spurious Emissions, Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.231(c) 20dB Bandwidth

Test Requirements: **§15.231(c):** The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. For devices operating above 900MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20dB down from the modulated carrier.

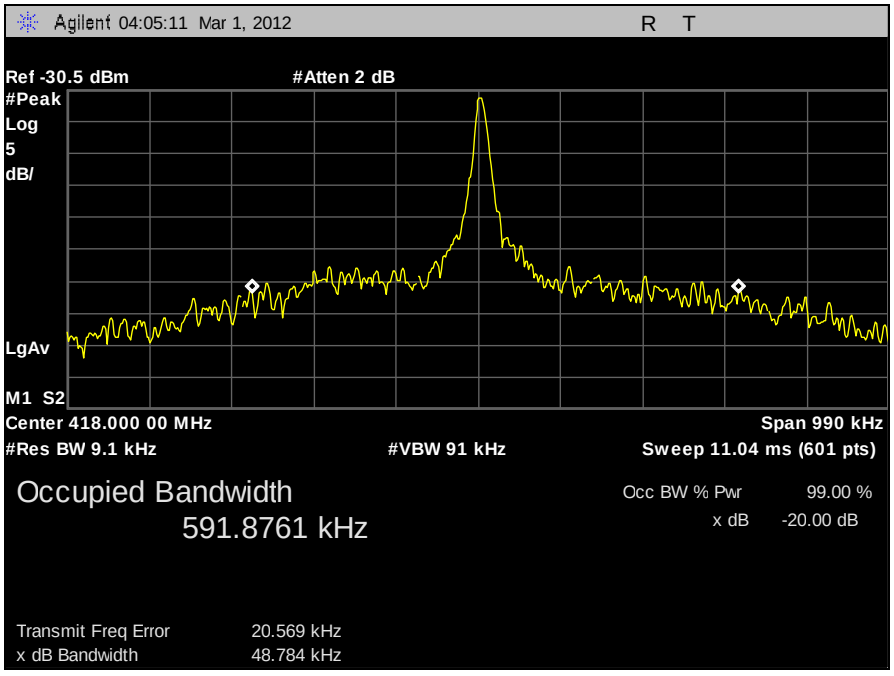
Test Results: Equipment complies with § 15.231(c).

Carrier Frequency(Fc) (MHz)	Measured 20 dB Bandwidth (kHz)	99% Bandwidth (kHz)	Limit (MHz) (0.25% of Fc)
418 MHz	48.784 kHz	591.8761 kHz	1.045 MHz

Table 14. 20dB Bandwidth Test Results

Test Engineer: Len Knight

Test Date: 03/05/12



Plot 13. 20 dB Bandwidth Plot

IV. Test Equipment

Test Equipment

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

MET #	Equipment	Manufacturer	Model#	Cal Date	Cal Due
1T4300	SEMI-ANECHOIC CHAMBER # 1	EMC TEST SYSTEMS	NONE	08/23/2010	08/23/2013
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	02/17/2012	02/17/2013
1T2342	LPA ANTENNA	EMCO	3146	07/13/2011	07/13/2012
1T4576	ANTENNA, ACTIVE HORN	COM-POWER	AHA-118	02/02/2012	02/02/2013
1T2511	ANTENNA; HORN	EMCO	3155	09/22/2011	09/22/2012
1T4612	SPECTRUM ANALYZER	AGILENT	E4407B	03/21/2012	03/21/2013
1T4751	ANTENNA – BILOG	SUNOL SCIENCES	JB6	12/07/2011	12/07/2012

Table 15. Test Equipment List

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.

End of Report

