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February 1, 2011

Ooma, Inc.
1840 Embarcadero Rd.
Palo Alto, CA 94303

Dear Michal Smulski,

Enclosed is the EMC Wireless test report for compliance testing of the Ooma, Inc., Telo as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 15, Subpart B for a B Digital Device and FCC Part 15 Subpart C 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: (\Ooma, Inc.\EMCS82796-FCC247)

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Electromagnetic Compatibility Criteria
Test Report

for the

Ooma, Inc.
Telo

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Parts 15 Subpart B
for B Digital Devices
&
15.247 Subpart C for Intentional Radiators

MET Report: EMCS82796-FCC247

February 1, 2011

Prepared For:

Ooma, Inc.
1840 Embarcadero Rd.
Palo Alto, CA 94303

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

Electromagnetic Compatibility Criteria
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Tested under
the FCC Certification Rules
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Title 47 of the CFR, Parts 15 Subpart B
for B Digital Devices
&
15.247 Subpart C for Intentional Radiators

Lionel Gabrillo, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Warnell
Documentation Department

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

Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab

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Report Status Sheet

Revision	Report Date	Reason for Revision
∅	February 1, 2011	Initial Issue.

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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
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**ert**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
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
µH	**microh**enry
µ	**microf**arad
µs	**micros**econds
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

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A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Ooma, Inc. Telo, 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 Telo. Ooma, Inc. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Telo, 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 Ooma, Inc., purchase order number 2433. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference 47 CFR Part 15.247:2005	Description	Compliance
47 CFR Part 15.107 (a)	Conducted Emission Limits for a Class B Digital Device	Compliant
47 CFR Part 15.109 (a)	Radiated Emission Limits for a Class B Digital Device	Compliant
Title 47 of the CFR, Part 15 §15.203	Antenna Requirement	Compliant
Title 47 of the CFR, Part 15 §15.205	Emissions at Restricted Band	Compliant
Title 47 of the CFR, Part 15 §15.207(a)	Conducted Emission Voltage	Compliant
Title 47 of the CFR, Part 15 §15.247(a)(1)	Channel Separation Occupied Bandwidth Number of Hopping Channels Time of Occupancy	Compliant
Title 47 of the CFR, Part 15 §15.247(b)	RF Output Power	Compliant
Title 47 of the CFR, Part 15 §15.209, §15.247(d)	Radiated and Conducted Spurious Emissions	Compliant
Title 47 of the CFR, Part15 15.247(g)	Hopping Capability	Compliant
Title 47 of the CFR, Part 15 §15.247(h)	Hopping Coordination Requirement	Compliant
Title 47 of the CFR, Part 15 §15.247(i)	Maximum Permissible Exposure	Compliant
N/A	Receiver Spurious Emissions	Compliant

Table 1. Executive Summary of EMC Part 15.247 ComplianceTesting

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II. Equipment Configuration

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A. Overview

MET Laboratories, Inc. was contracted by Ooma, Inc. to perform testing on the Telo, under Ooma, Inc.'s purchase order number 2433.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Ooma, Inc., Telo.

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

Model(s) Tested:	Telo	
Model(s) Covered:	Telo	
EUT Specifications:	Primary Power: 120 VAC, 60 Hz	
	FCC ID: XFT-TELO102	
	Type of Modulations:	FHSS
	Equipment Code:	DSS
	Peak RF Output Power:	-0.8dBm
	EUT Frequency Ranges:	2402 MHz – 2480 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:	Lionel Gabrillo	
Report Date(s):	February 1, 2011	

Table 2. EUT Summary Table

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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
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., 3162 Belick St., Santa Clara, CA 95054. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a 10 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

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D. Description of Test Sample

The Ooma, Inc. Telo, is a VOIP router with DECT radio and PSTN line interface.

Photograph 1. Ooma Telo

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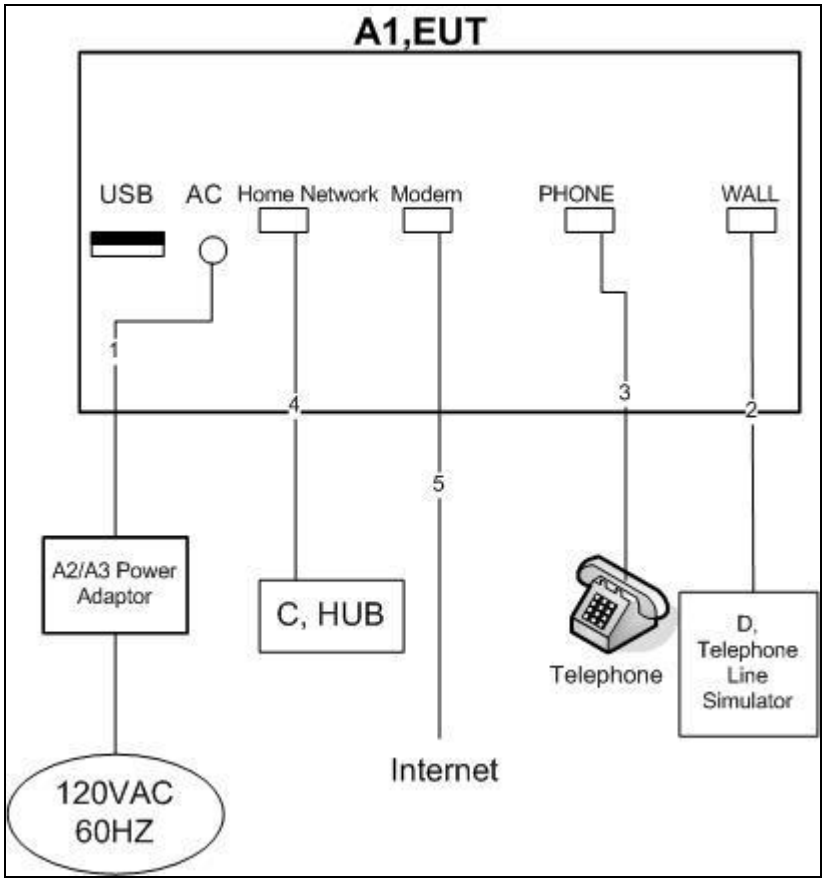

Figure 1. Block Diagram of Test Configuration

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E. Equipment Configuration

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

Ref. ID	Name / Description	Model Number	Part Number	Serial Number
A1	Telo	N/A	NA	001861040120
A2	Power Adaptor	JENTEC CF1505-B	NA	1R00103600001
A3	Power Adaptor	CYA0015BUH01	160-0113-00	LS1001S16036

Table 4. Equipment Configuration

F. Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

Ref. ID	Name / Description	Manufacturer	Model Number	Customer Supplied Calibration Data
B	DECT Handset	Ooma	HC-1001	N/A
C	HUB	Netgear	DS104	N/A
D	Telephone Line Simulator	Teltone	TLS-4A-01	N/A
E	Bluetooth Device	Plantronics	Explorer 240	N/A
F	Telephone	AT&T	210M	N/A
G	USB Bluetooth Hub Dongle	Ooma	FCC ID: SI4-MBD-200X	N/A

Table 5. Support Equipment

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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 Name
1	A1,AC	Power cord	1	1	N	A2/A3, VAC Power Supply
2	A1, Wall	RJ11	1	8	N	D, Telephone Line Simulator
3	A1, Phone	RJ11	1	1	N	F, Telephone
4	A1, Home Network	RJ45	1	8	N	C, HUB
5	A1,Modem	RJ45	1	8	N	Internet

Table 6. Ports and Cabling Information

H. Mode of Operation

Power Up
1. connect Network: home + modem
2. Connect Phone
3. Connect PSTN line
4. Bond with DECT Phone
5. Bond with Bluetooth device

I. 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.

J. Disposition of EUT

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

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III. Electromagnetic Compatibility Criteria for Unintentional Radiators

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

Test Engineer(s): Daniel Salinas

Test Date(s): 11/10/2010

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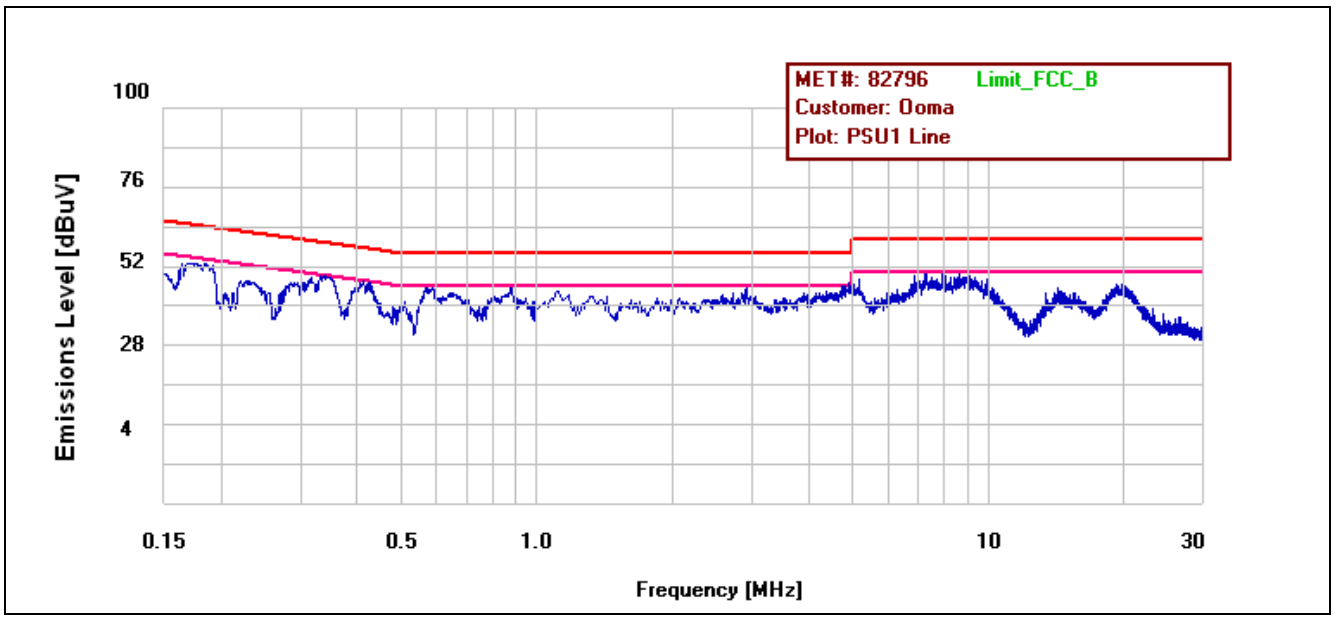
Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz)

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
PSU1 120 VAC Line	.168	49.7	65.061	-15.361	Pass	35.78	55.061	-19.281	Pass
PSU1 120 VAC Line	.331	42.89	59.444	-16.554	Pass	33.72	49.444	-15.724	Pass
PSU1 120 VAC Line	.406	43.88	57.752	-13.872	Pass	36.28	47.752	-11.472	Pass
PSU1 120 VAC Line	.581	41.72	56	-14.28	Pass	32.5	46	-13.5	Pass
PSU1 120 VAC Line	.881	40.71	56	-15.29	Pass	29.71	46	-16.29	Pass
PSU1 120 VAC Line	2.1	36.92	56	-19.08	Pass	28.34	46	-17.66	Pass
PSU1 120 VAC Line	2.882	38.3	56	-17.7	Pass	29.02	46	-16.98	Pass
PSU1 120 VAC Line	5.02	39.95	60	-20.05	Pass	31.62	50	-18.38	Pass
PSU1 120 VAC Line	7.925	46.04	60	-13.96	Pass	36.52	50	-13.48	Pass
PSU1 120 VAC Line	8.72	45.83	60	-14.17	Pass	37.19	50	-12.81	Pass
PSU1 120 VAC Line	20.2	41.14	60	-18.86	Pass	33.65	50	-16.35	Pass

Table 8. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz), (PSU: CYA0015BUH01)



Plot 1. Conducted Emission, Phase Line Plot, (PSU: CYA0015BUH01)

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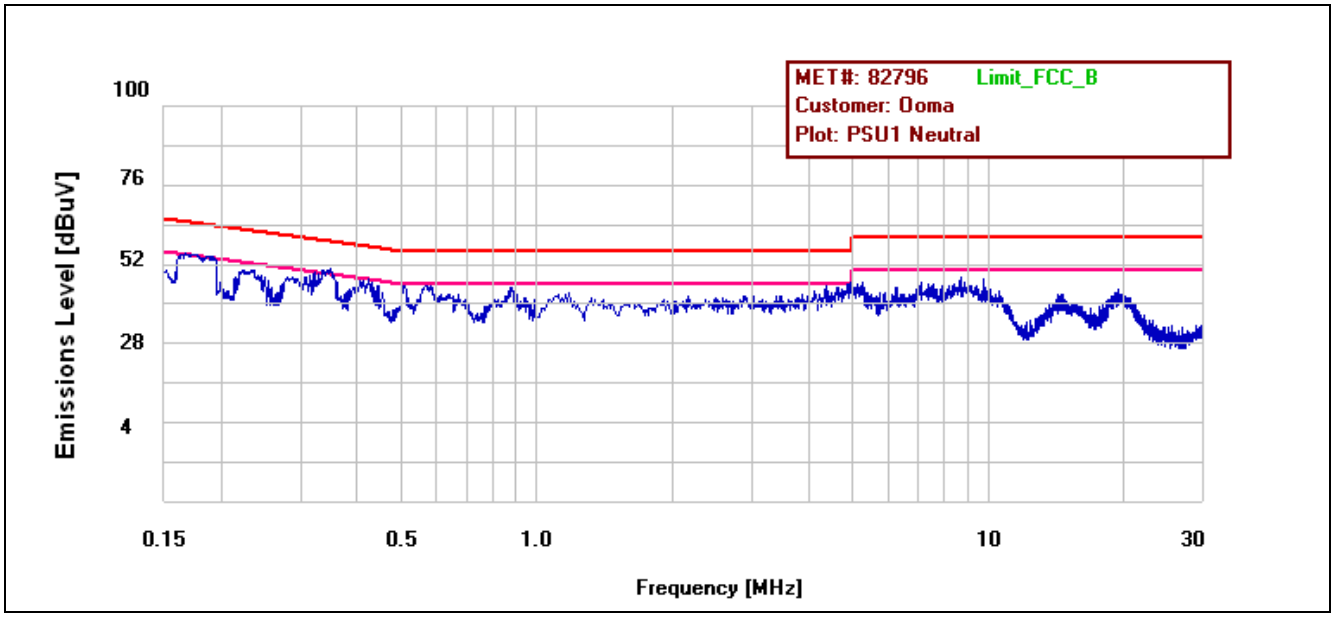
Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz)

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
PSU1 120 VAC Neutral	.174	52.41	64.771	-12.361	Pass	40.88	54.771	-13.891	Pass
PSU1 120 VAC Neutral	.338	46.41	59.271	-12.861	Pass	37.36	49.271	-11.911	Pass
PSU1 120 VAC Neutral	.415	41.75	57.571	-15.821	Pass	32.66	47.571	-14.911	Pass
PSU1 120 VAC Neutral	.5142	35.14	56	-20.86	Pass	25.07	46	-20.93	Pass
PSU1 120 VAC Neutral	.578	41.02	56	-14.98	Pass	32.67	46	-13.33	Pass
PSU1 120 VAC Neutral	.870	39.28	56	-16.72	Pass	30.25	46	-15.75	Pass
PSU1 120 VAC Neutral	5.13	39.67	60	-20.33	Pass	29.32	50	-20.68	Pass
PSU1 120 VAC Neutral	8.84	39.93	60	-20.07	Pass	31.34	50	-18.66	Pass

Table 9. Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz), (PSU: CYA0015BUH01)

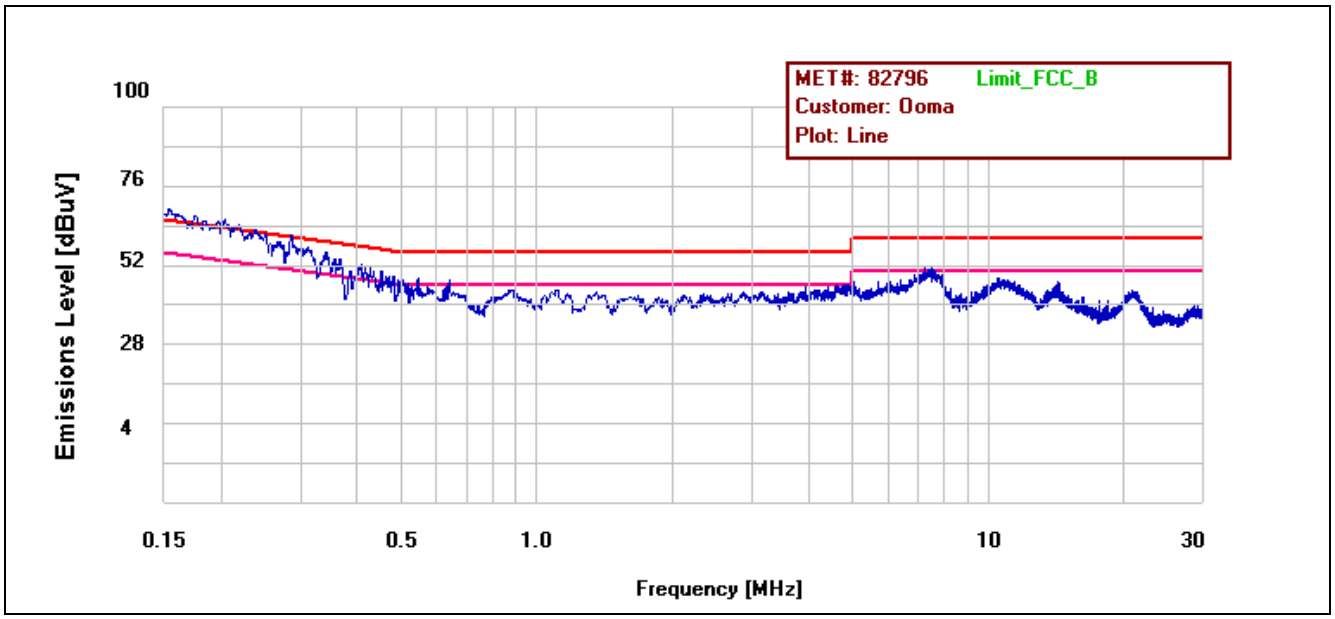


Plot 2. Conducted Emission, Neutral Line Plot, (PSU: CYA0015BUH01)

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

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
Line	0.1756	55.1	64.695	-9.595	Pass	36.33	54.695	-18.365	Pass
Line	0.2191	47.5	62.862	-15.362	Pass	25.64	52.862	-27.222	Pass
Line	0.3437	45.43	59.132	-13.702	Pass	37.65	49.132	-11.482	Pass
Line	0.4101	42.8	57.669	-14.869	Pass	34.32	47.669	-13.349	Pass

Table 10. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz), (PSU: JENTEC CF1505-B)



Plot 3. Conducted Emission, Phase Line Plot, (PSU: JENTEC CF1505-B)

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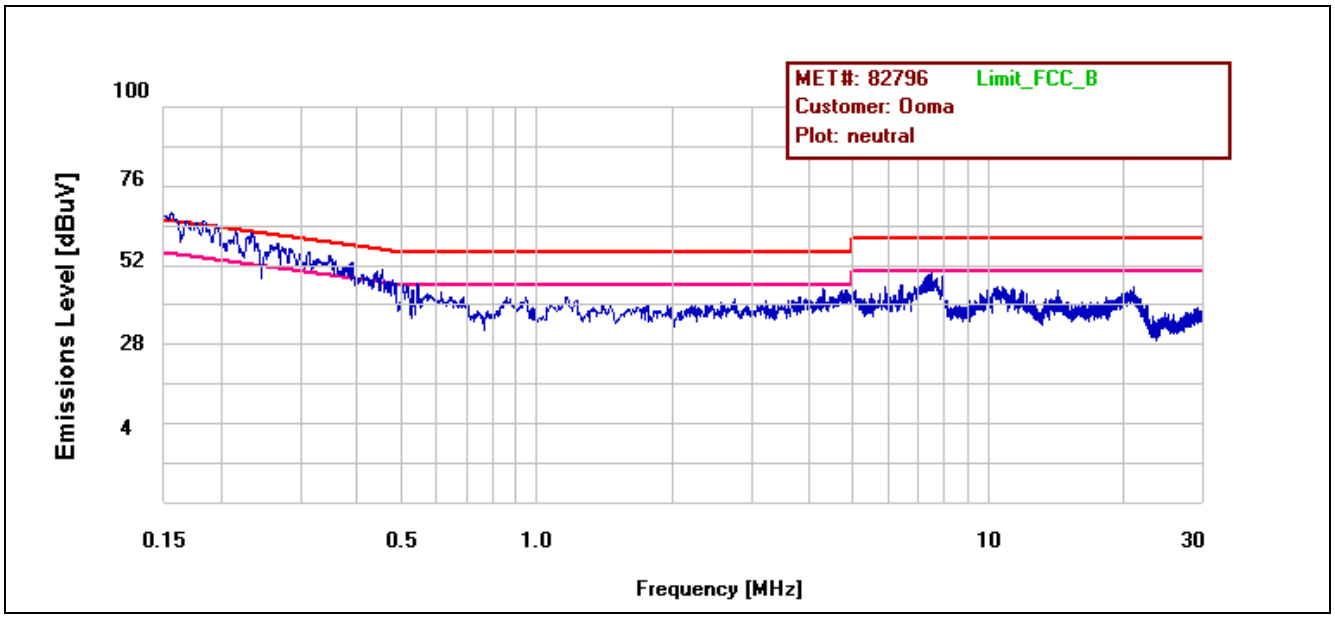
Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz)

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
Neutral	0.1635	53.27	65.286	-12.016	Pass	19.58	55.286	-35.706	Pass
Neutral	0.2005	48.07	63.596	-15.526	Pass	16.94	53.596	-36.656	Pass
Neutral	0.3015	41.47	60.217	-18.747	Pass	23.34	50.217	-26.877	Pass
Neutral	7.670	38.93	60	-21.07	Pass	25.05	50	-24.95	Pass

Table 11. Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz), (PSU: JENTEC CF1505-B)



Plot 4. Conducted Emission, Neutral Line Plot, (PSU: JENTEC CF1505-B)

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Conducted Emission Limits Test Setup

Photograph 2. Conducted Emissions, Test Setup

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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 12.

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 12.

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

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 compliant with the Class B requirement(s) of this section. Measured emissions were below applicable limits

Test Engineer(s): Daniel Salinas and Anderson Soungpanya

Test Date(s): 11/10/10 and 11/23/10

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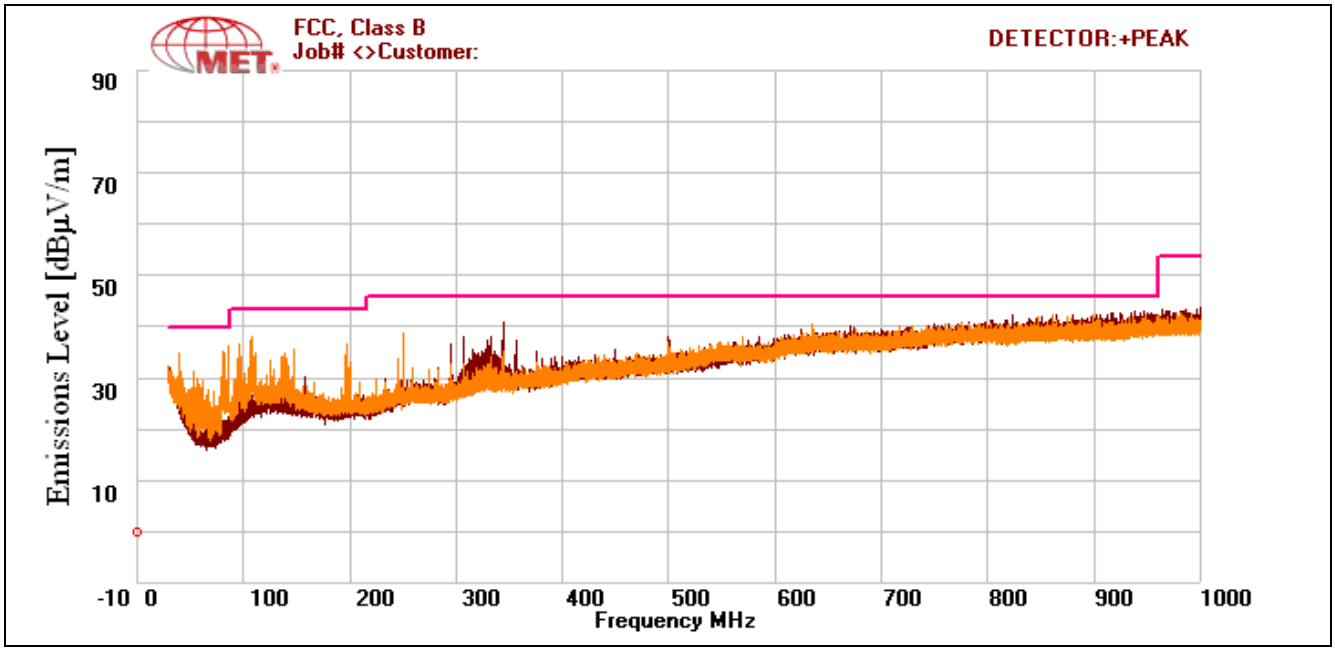
Radiated Emissions Limits Test Results, Class B

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBuV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
106.7	V	207	100	21.02	12.768	0	2.921	0	36.709	43.5	-6.791
86	V	82	135	22.64	8.36	0	2.548	0	33.548	40	-6.452
40.3	V	299	100	18.82	11.75	0	1.544	0	32.114	40	-7.886
250	V	292	100	22.72	12.7	0	3.74	0	39.16	46	-6.84
344	H	294	100	22.38	14.88	0	3.825	0	41.085	46	-4.915
307.45	H	118	100	19.87	14.049	0	3.613	0	37.532	46	-8.468
1000	H	239	100	73.68	27.216	77.23	7.5	0	31.166	54	-22.834
1000	V	44	100	74.36	27.216	77.23	7.5	0	31.846	54	-22.154
1815	H	356	137	67.74	29.991	75.496	9.912	0	32.147	54	-21.853
1815	V	346	109	68.45	29.991	75.496	9.912	0	32.857	54	-21.143
1575	H	121	100	65.84	28.697	75.788	9.24	0	27.989	54	-26.011
1155	H	359	100	66.8	27.55	76.812	7.974	0	25.512	54	-28.488

Table 13. Radiated Emissions Limits Test Results, Configuration 1



Plot 5. Radiated Emissions Pre-Scan, 30 MHz – 1 GHz, Configuration 1

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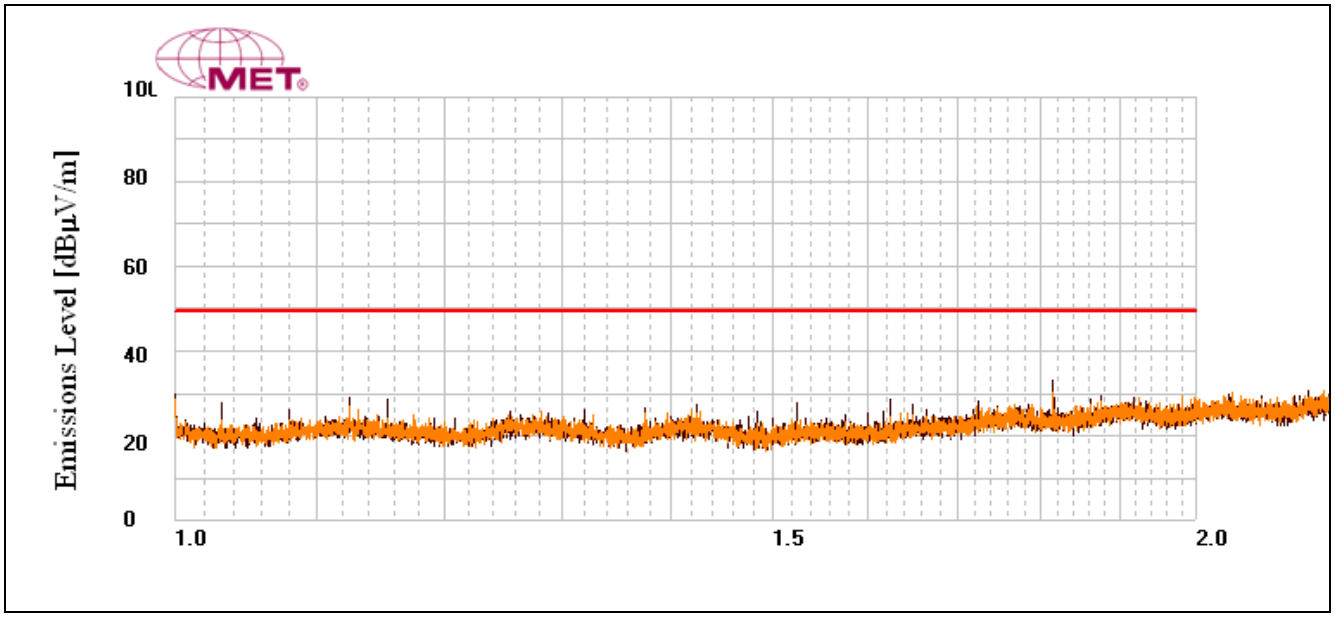

Plot 6. Radiated Emissions Pre-Scan, 1 GHz – 2 GHz, Configuration 1

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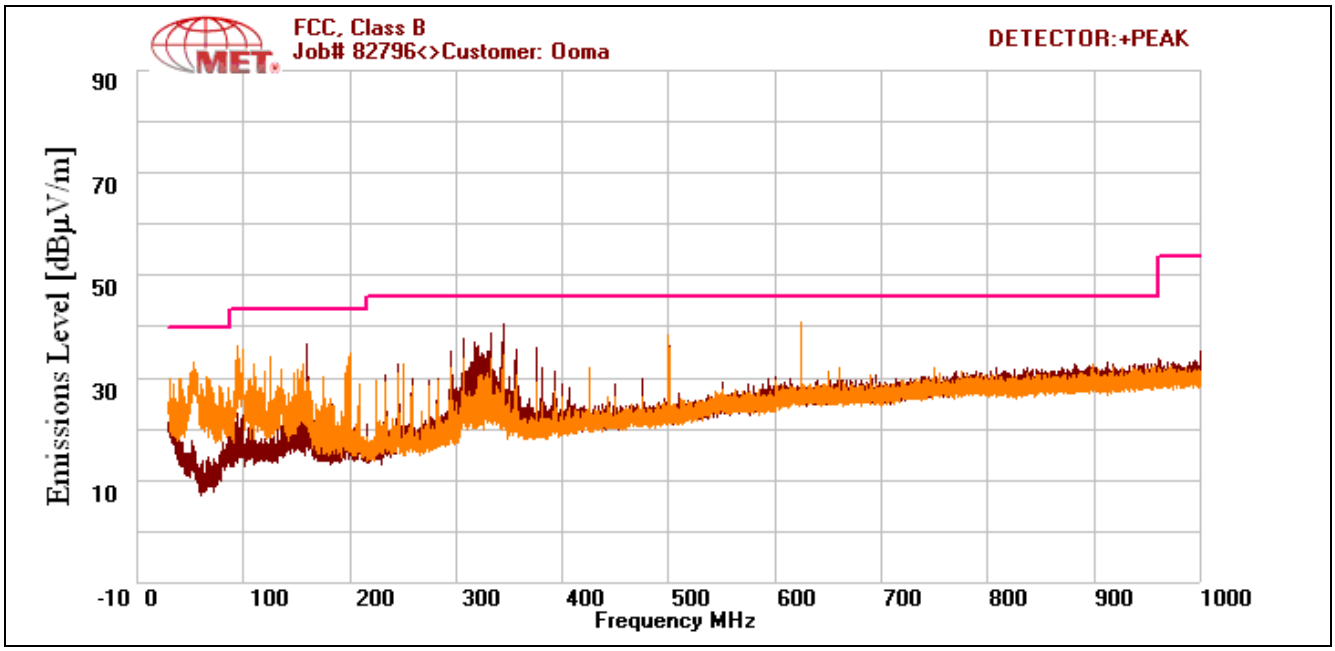
Radiated Emissions Limits Test Results, Class B

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBuV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
51.81	V	217	100	22.89	7.319	0	1.855	0	32.064	40	-7.936
92.71	V	68	100	16.23	10.721	0	2.693	0	29.644	43.5	-13.856
499.98	V	267	134	16.55	17.6	0	4.72	0	38.87	46	-7.13
625	V	213	100	14.51	18.9	0	5.32	0	38.73	46	-7.27
161.37	H	0	100	18.11	10.645	0	3.501	0	32.256	43.5	-11.244
344	H	29	100	25.72	14.88	0	3.825	0	44.425	46	-1.575

Table 14. Radiated Emissions Limits Test Results, (PSU: JENTEC CF1505-B)



Plot 7. Radiated Emissions Pre-Scan, 30 MHz – 1 GHz, (PSU: JENTEC CF1505-B)

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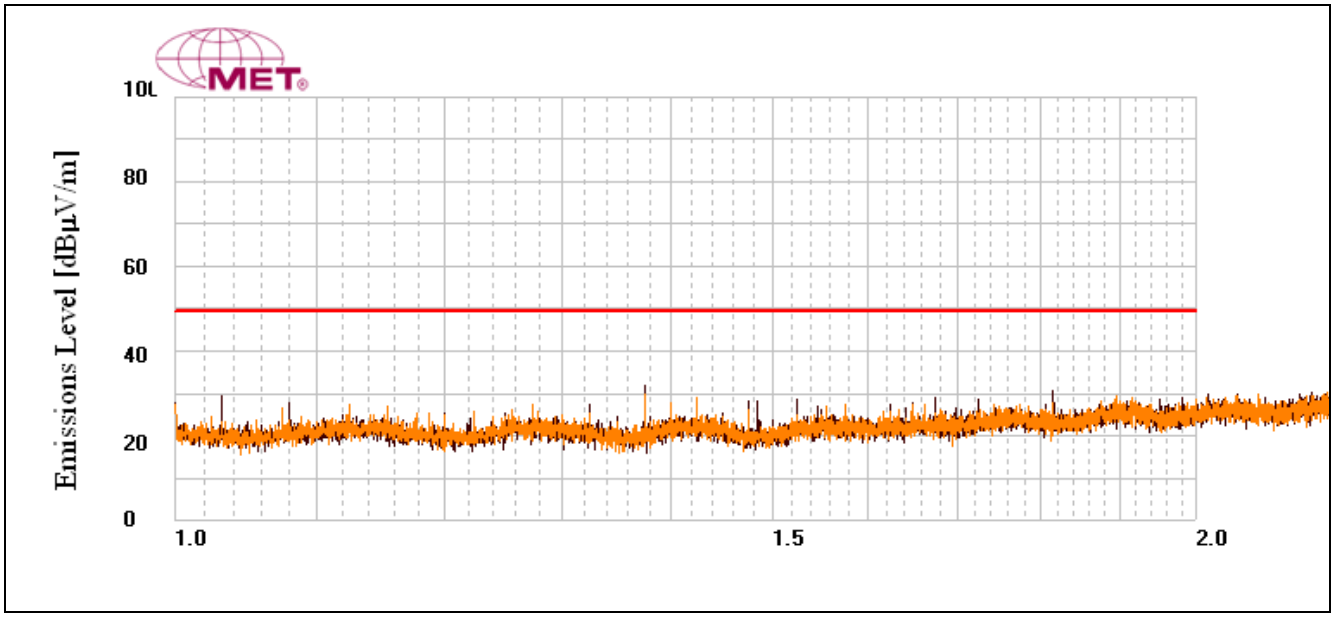

Plot 8. Radiated Emissions Pre-Scan, 1 GHz – 2 GHz, (PSU: JENTEC CF1505-B)

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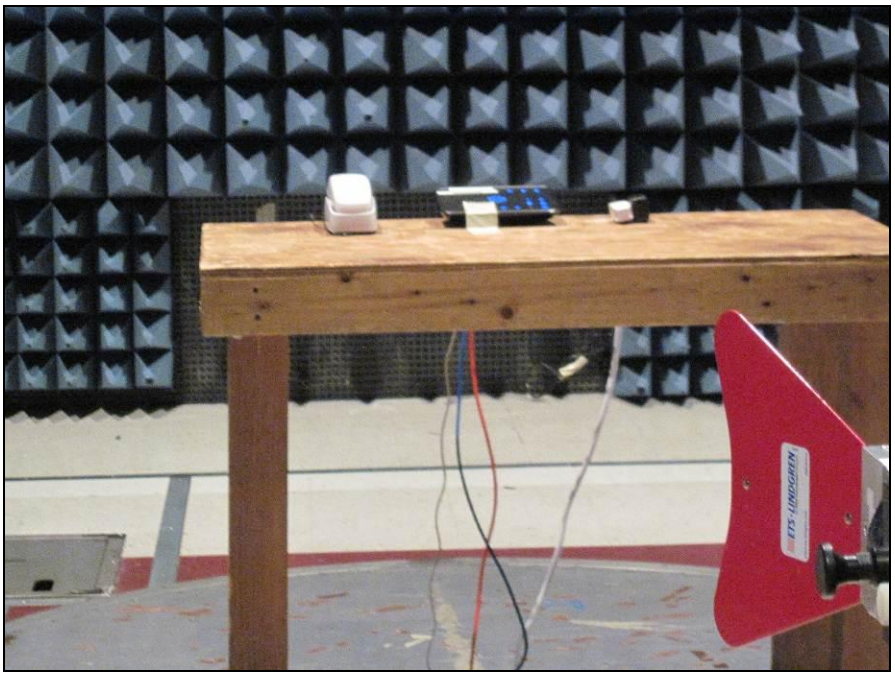
Radiated Emission Limits Test Setup

Photograph 3. Radiated Emission, Test Setup, Mid-Range



Photograph 4. Radiated Emission, Test Setup, High-End

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IV. Electromagnetic Compatibility Criteria for Intentional Radiators

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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 being a permanently attached integral antenna.

Test Engineer(s): Lionel Gabrillo

Test Date(s): 11/30/10

Gain	Type	Model	Manufacturer
4dBi	Inverted-F	SMD	Ooma

Table 15. Antenna List

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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 16. 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): Jia Li

Test Date(s): 01/05/11

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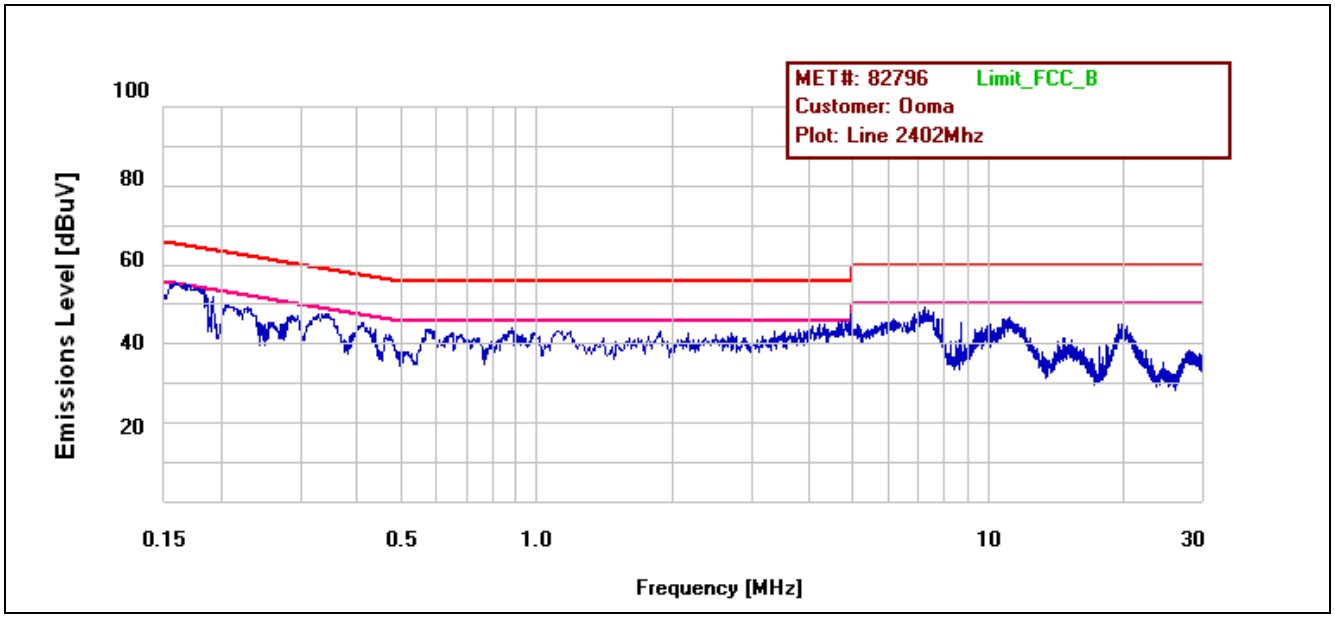
15.207 Conducted Emissions Test Results

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
Line	0.1584	51.85	65.549	-13.699	Pass	35.3	55.549	-20.249	Pass
Line	7.119	41.99	60	-18.01	Pass	32.22	50	-17.78	Pass
Line	0.2243	44.15	62.667	-18.517	Pass	28.74	52.667	-23.927	Pass
Line	0.3459	44.04	59.079	-15.039	Pass	33.78	49.079	-15.299	Pass
Line	0.4205	40.59	57.462	-16.872	Pass	31.3	47.462	-16.162	Pass
Line	6.194	40.8	60	-19.2	Pass	30.72	50	-19.28	Pass

Table 17. Conducted Emissions, 15.207, Phase Line, Test Results



Plot 9. Conducted Emissions, 15.207, Phase Line

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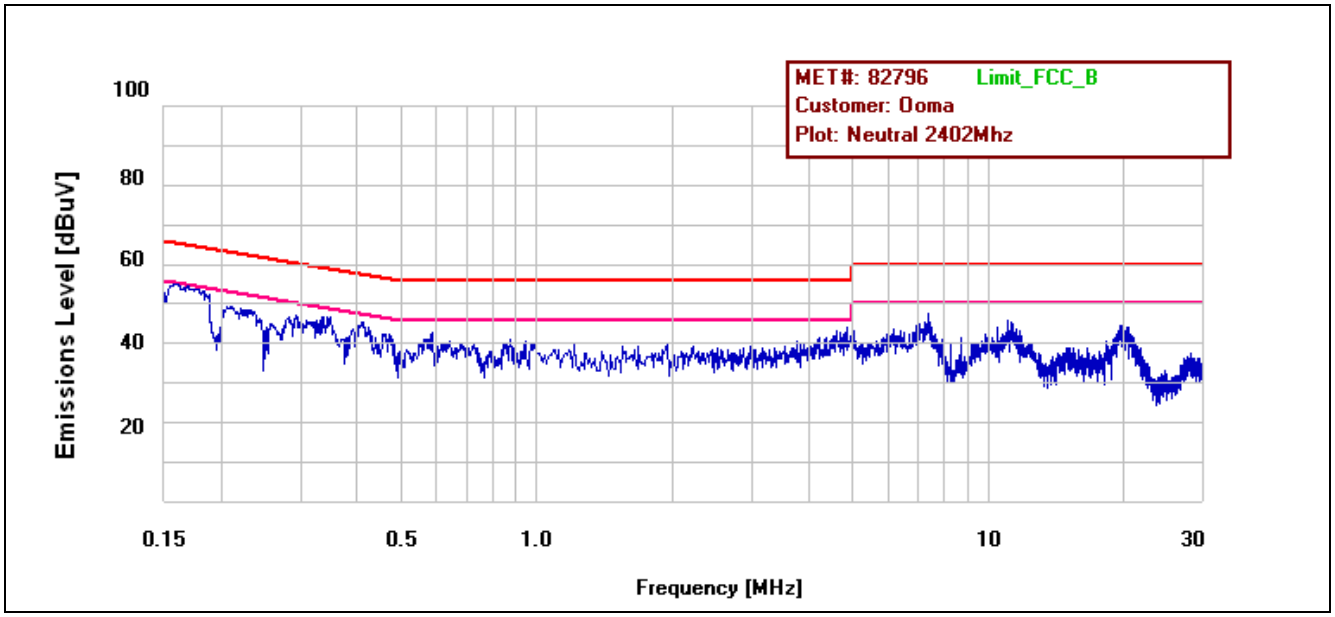
15.207 Conducted Emissions Test Results

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
Neutral	0.1593	51.17	65.502	-14.332	Pass	30.75	55.502	-24.752	Pass
Neutral	0.211	45.61	63.174	-17.564	Pass	27.22	53.174	-25.954	Pass
Neutral	0.342	41.42	59.173	-17.753	Pass	28.01	49.173	-21.163	Pass

Table 18. Conducted Emissions, 15.207, Neutral Line, Test Results



Plot 10. Conducted Emissions, 15.207, Neutral Line

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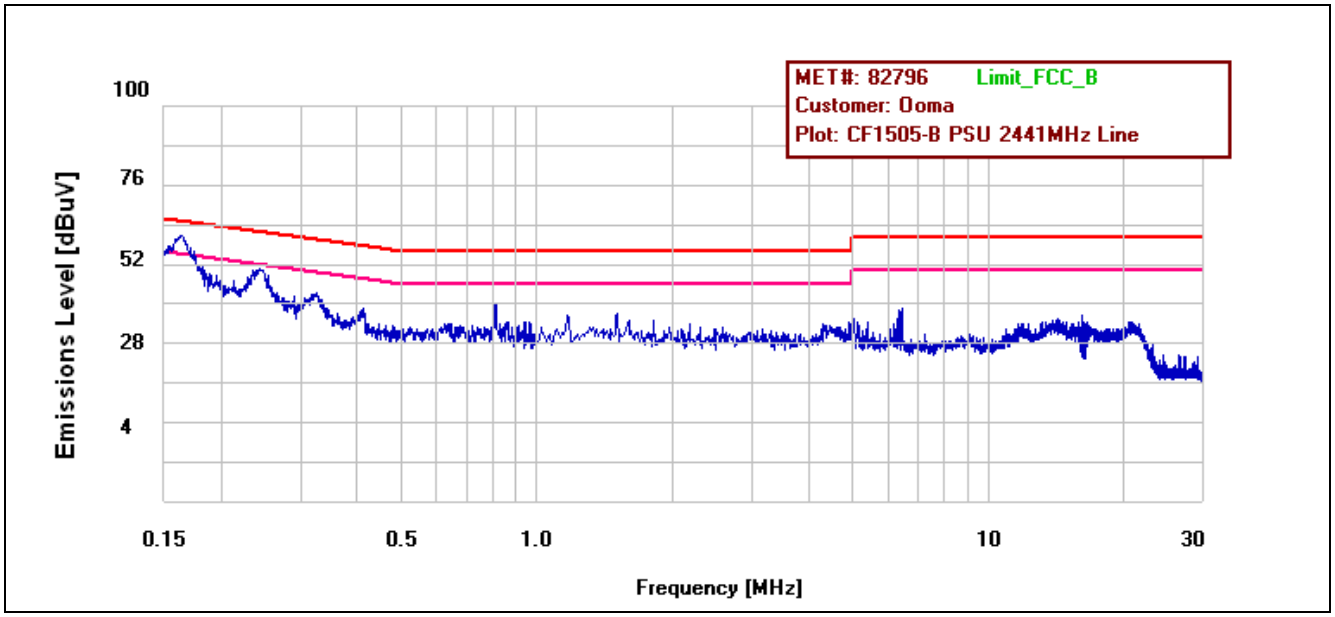
Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
CF1505-B PSU 2441MHz Line	0.1635	58.13	65.286	-7.156	Pass	44.49	55.286	-10.796	Pass
CF1505-B PSU 2441MHz Line	0.242	47.34	62.038	-14.698	Pass	33.27	52.038	-18.768	Pass
CF1505-B PSU 2441MHz Line	0.811	34.26	56	-21.74	Pass	30.14	46	-15.86	Pass

Table 19. Conducted Emissions, 15.207, Phase Line, Test Results (PSU: JENTEC CF1505-B)



Plot 11. Conducted Emissions, 15.207, Phase Line (PSU: JENTEC CF1505-B)

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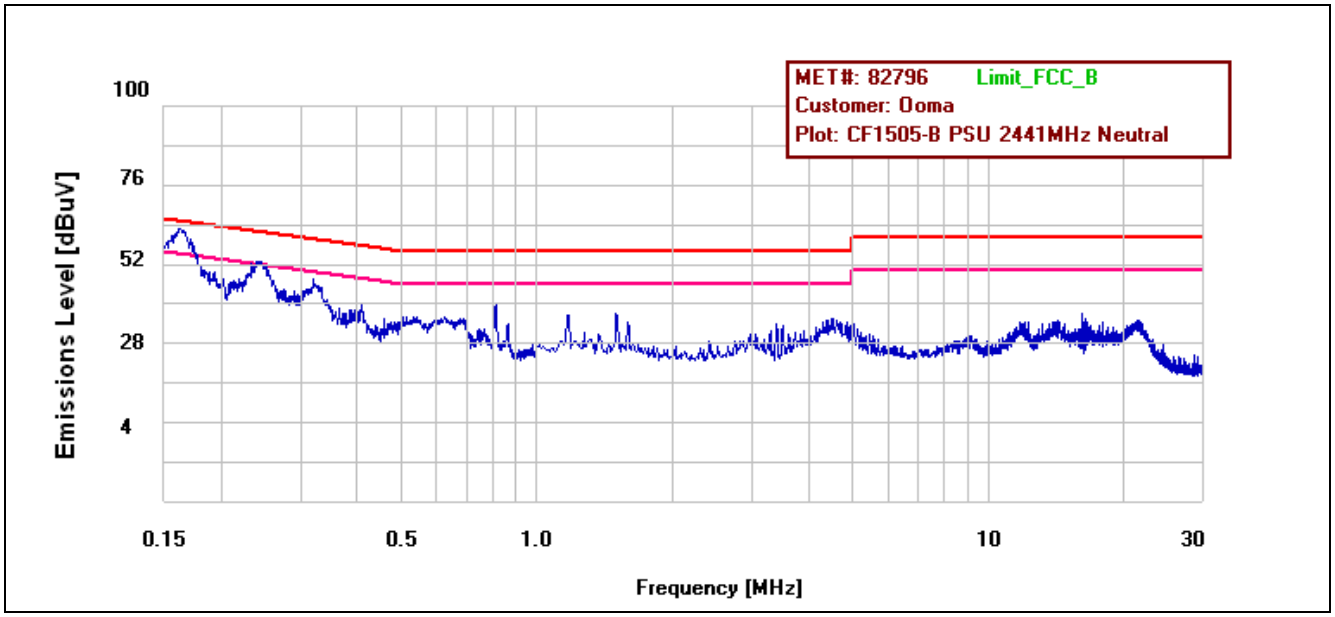
Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
CF1505-B PSU 2441MHz Neutral	0.1635	60.19	65.286	-5.096	Pass	47.19	55.286	-8.096	Pass
CF1505-B PSU 2441MHz Neutral	0.2458	49.03	61.909	-12.879	Pass	37.51	51.909	-14.399	Pass
CF1505-B PSU 2441MHz Neutral	0.3265	41.32	59.557	-18.237	Pass	30.6	49.557	-18.957	Pass

Table 20. Conducted Emissions, 15.207, Neutral Line, Test Results (PSU: JENTEC CF1505-B)



Plot 12. Conducted Emissions, 15.207, Neutral Line (PSU: JENTEC CF1505-B)

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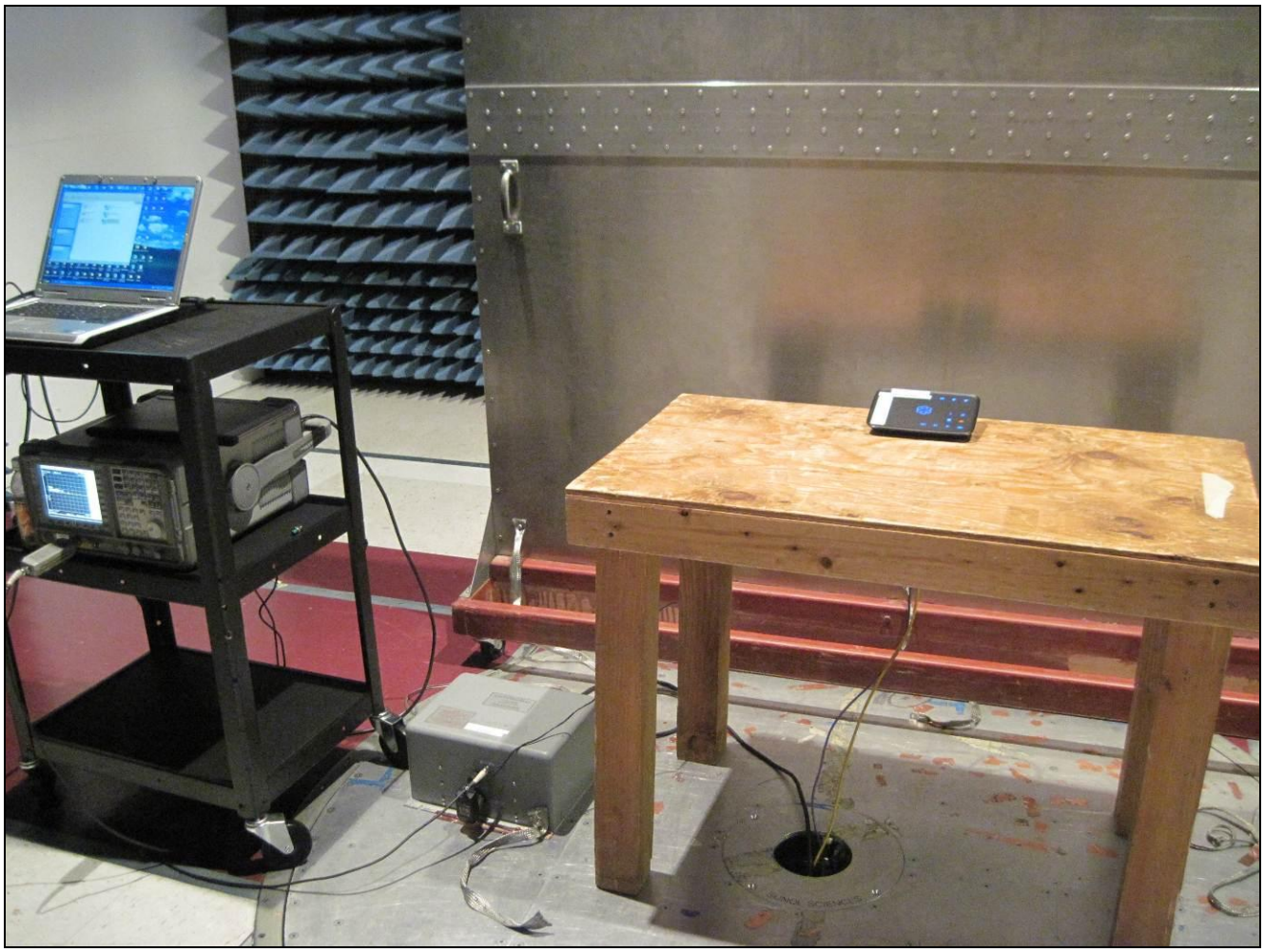
15.207 Conducted Emissions Test Setup Photo



Photograph 5. Conducted Emissions, 15.207, Test Setup

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Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(a) Bandwidth & Channelization Requirements

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. For DTS, the minimum 6 dB bandwidth shall be at least 500 kHz. For frequency hopping systems, the EUT shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Test Procedure: The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately equal to 1% of the total emission bandwidth. The 20 dB bandwidth was measured and recorded.

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

The 20 dB and 99% Bandwidth was determined from the plots on the following pages.

Test Engineer(s): Lionel Gabrillo

Test Date(s): 12/17/10

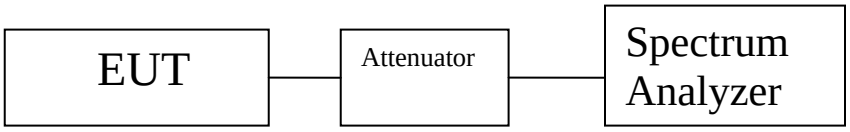

Figure 2. Block Diagram, Occupied Bandwidth Test Setup

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Occupied Bandwidth Test Results

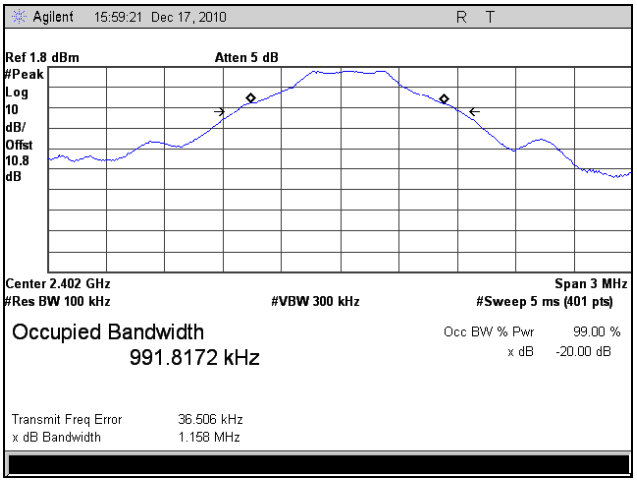
Occupied Bandwidth		
Carrier Channel	**Frequency (MHz)**	**Measured 20 dB Bandwidth (MHz)**
Low	2402	1.158
Mid	2441	1.162
High	480	1.161

Table 21. 20dB Occupied Bandwidth, Test Results

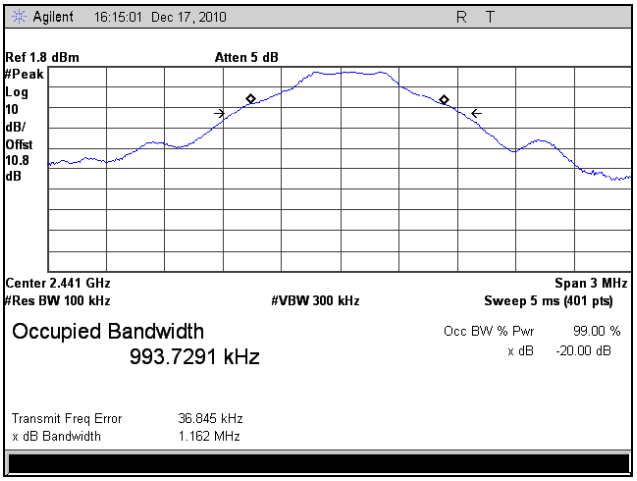
Occupied Bandwidth		
Carrier Channel	**Frequency (MHz)**	**Measured 99% Bandwidth (kHz)**
Low	2402	882.7204
Mid	2441	877.1156
High	480	876.4916

Table 22. 99% Occupied Bandwidth, Test Results

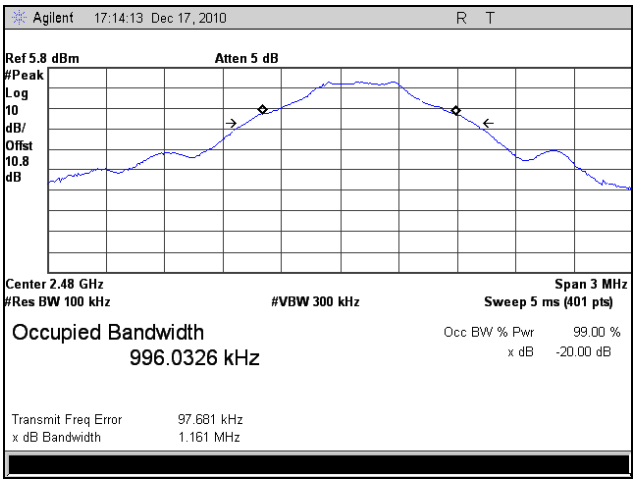
Occupied Bandwidth Test Results



Plot 13. 20dB Occupied Band Width, Low Channel



Plot 14. 20dB Occupied Band Width, Mid Channel



Plot 15. 20dB Occupied Band Width, High Channel

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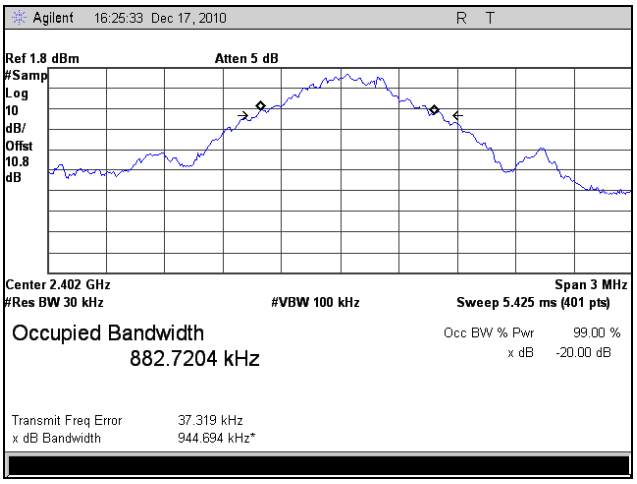
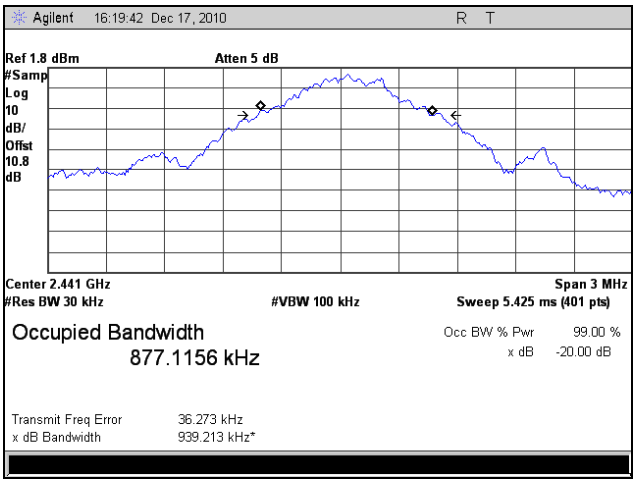
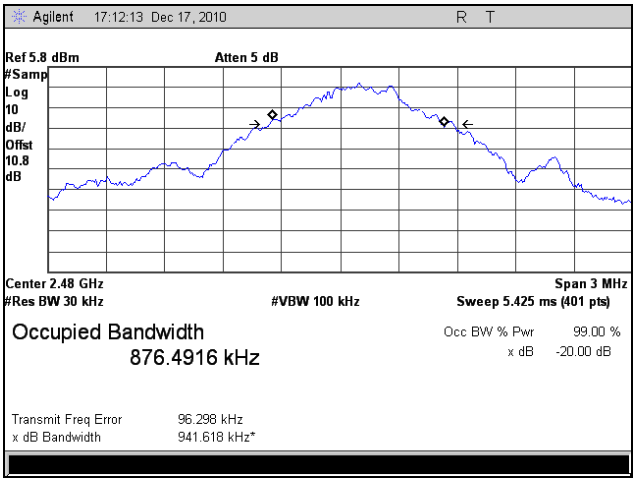


Plot 16. 99% Occupied Band Width, Low Channel



Plot 17. 99% Occupied Band Width, Mid Channel



Plot 18. 99% Occupied Band Width, High Channel

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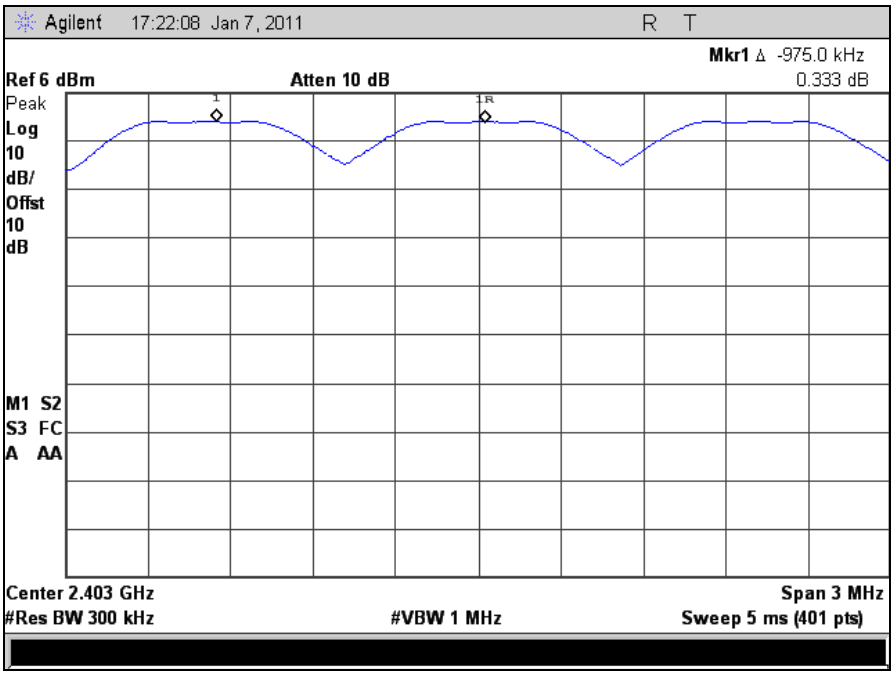
Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247 Carrier Frequency Separation

Remarks: Total hopping channels = 79. The EUT meets the specifications of Section 15.247(a) (1) (iii) for Number of Hopping Channels.



Plot 19. Separation between Channels 1 & 2

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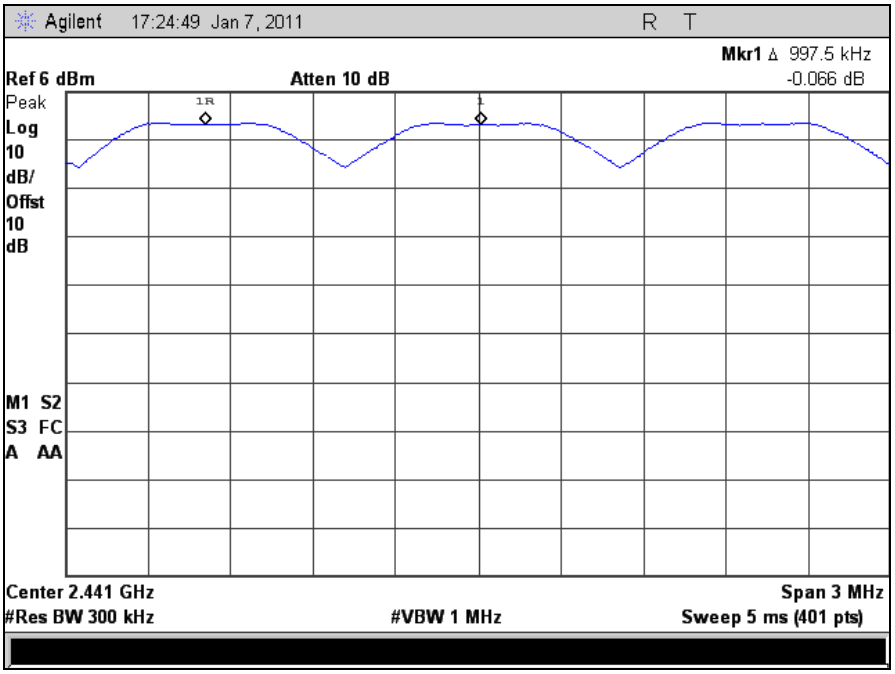
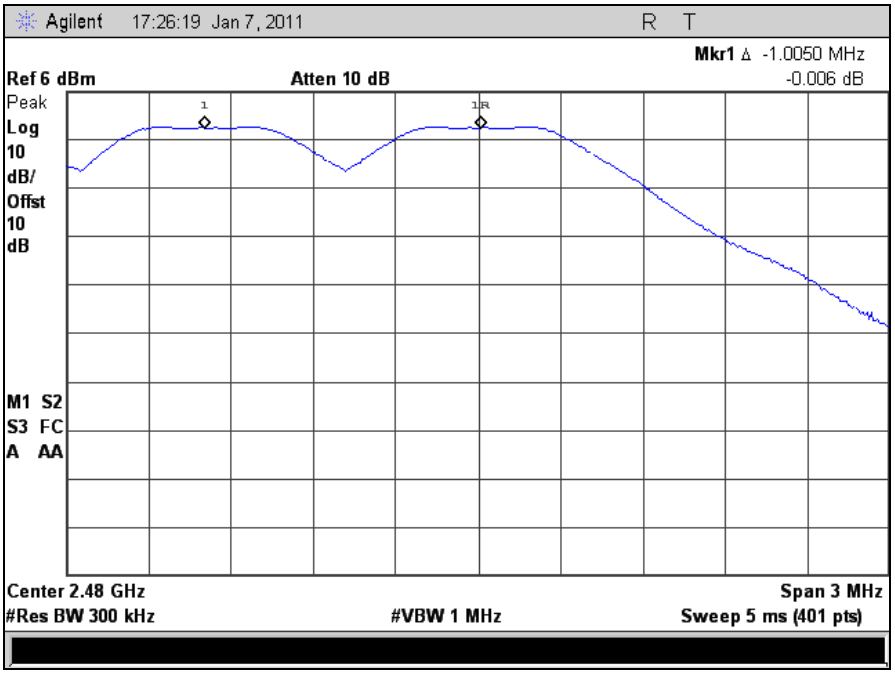


Plot 20. Separation between Channels 38 & 39



Plot 21. Separation between Channels 77 & 78

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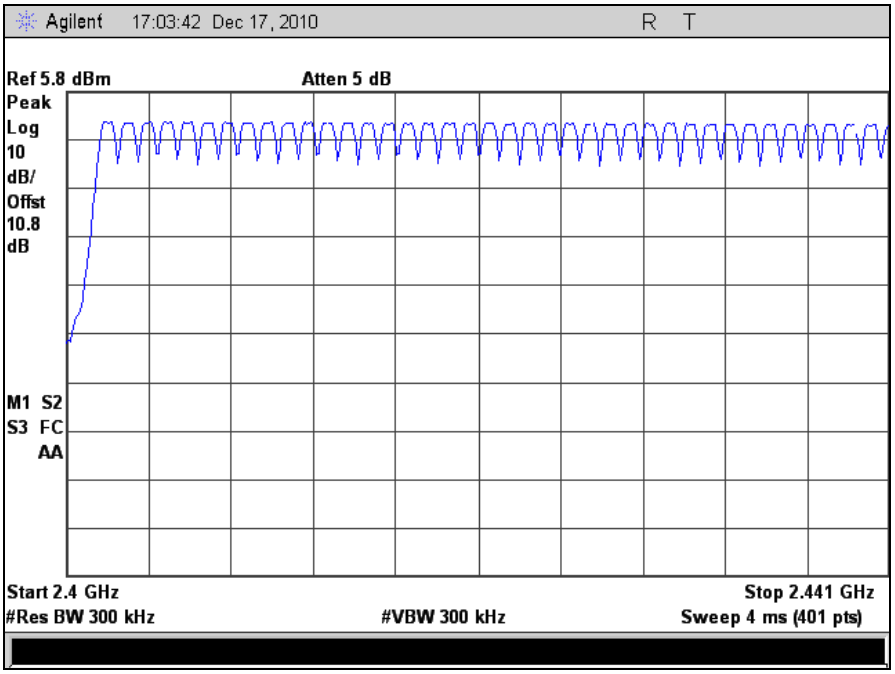
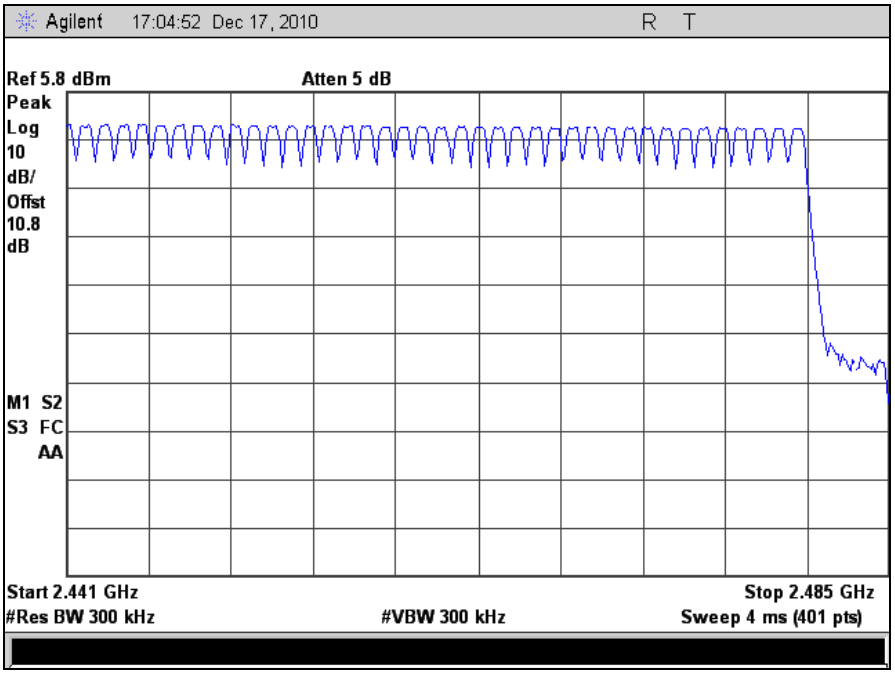
Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247 Number of Hopping Channels



Plot 22. No. of Channels, a



Plot 23. No. of Channels, b

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Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247 Time of Occupancy

Test Requirements: **§ 15.247(a) (1) (iii):** Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular frequency provided that a minimum of 15 channels are used.

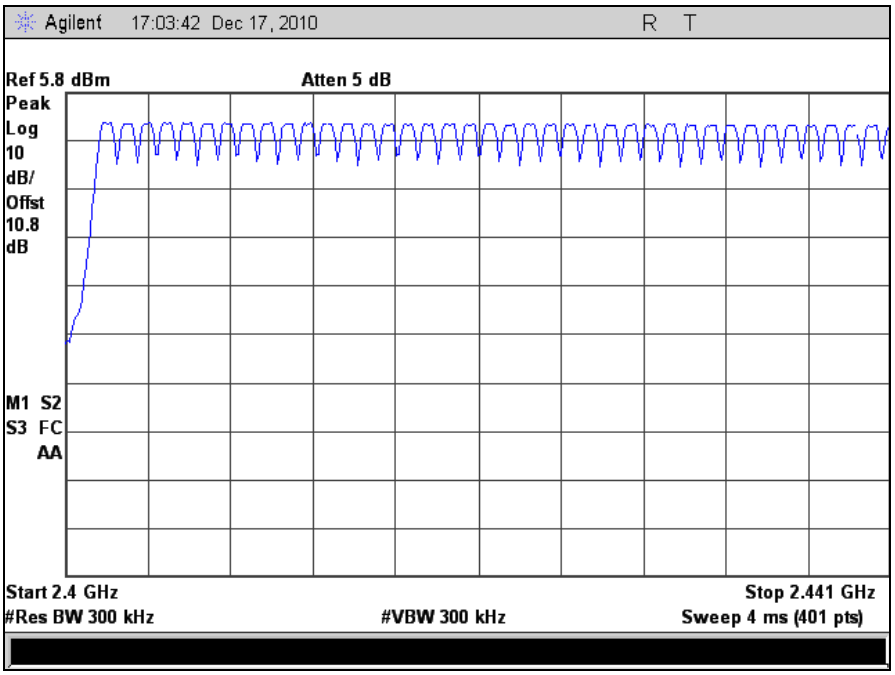
Test Procedures: The EUT's transmitter output was connected directly to the spectrum analyzer. Plots were taken in order to measure the number of channels and Dwell Time.

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

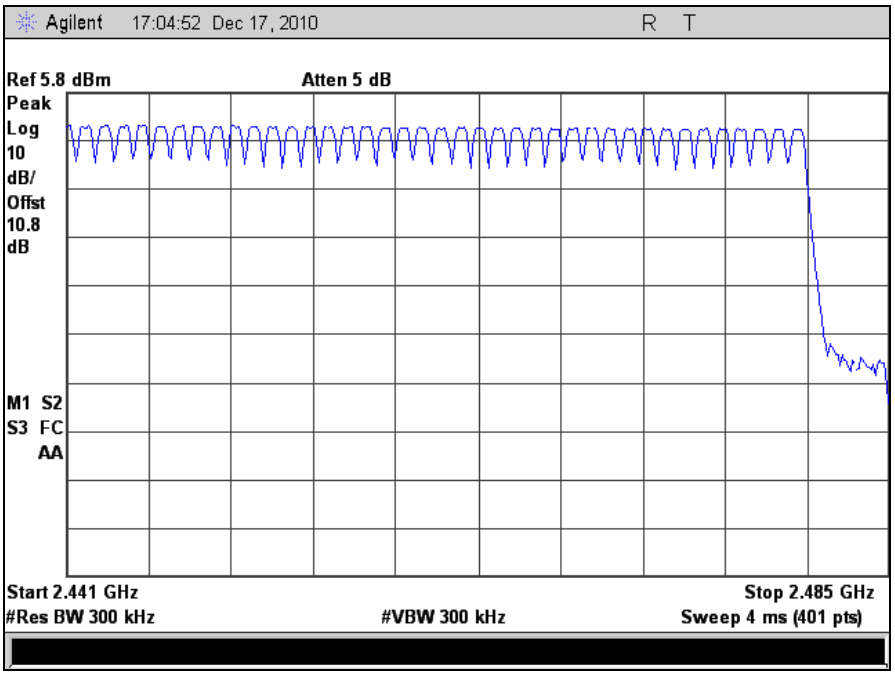
1) Number of Channels
This device has 79 channels.

2) Average Time Of Occupancy

The Dwell Time for each packet type is recorded .The device has 79 channels. The average time of occupancy in a 31.6 seconds period (79 * 0.4) is equal to 10* (#of pulses)*pulse width.



Plot 24. Number of Channels, Segment 1



Plot 25. Number of Channels, Segment 2

DH Packet	Pulse Width (ms)	Number of Pulses	Dwell Time (Sec)	Limit (Second)	Margin
1	0.38	32	0.121	0.4	0.279
3	1.622	16	0.259	0.4	0.141
5	2.76	11	0.304	0.4	0.096

Table 23. Time of Occupancy, DH1

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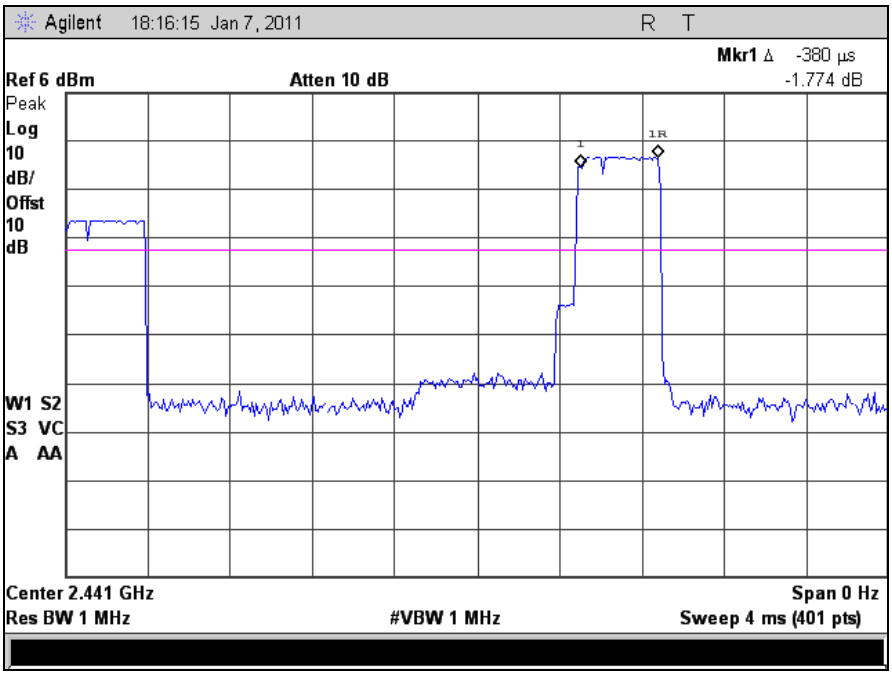
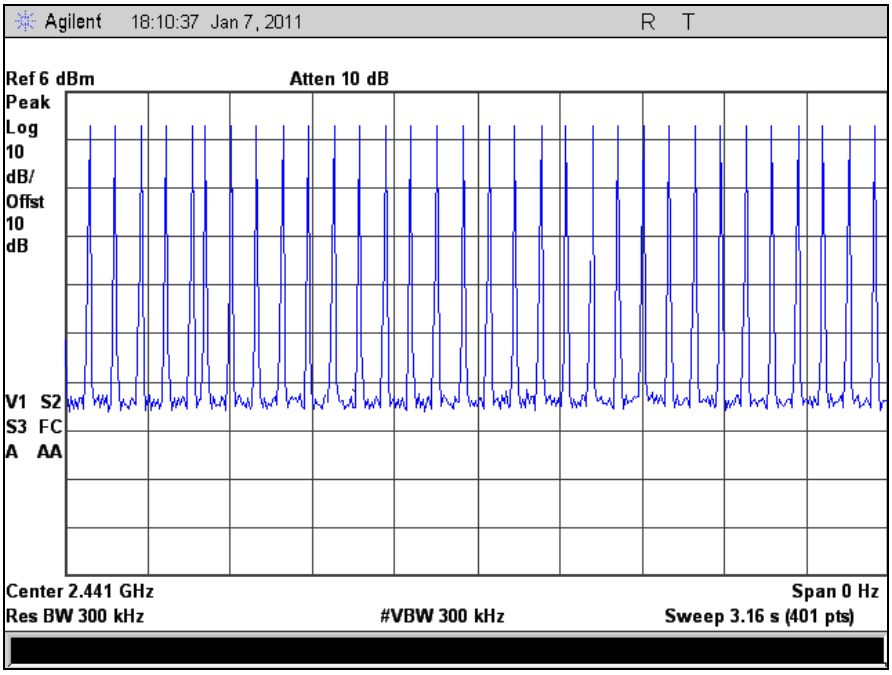


Plot 26. DH1, Pulse Width



Plot 27. DH1, Number of Times a Channel is Repeated in a 3.16 second Period

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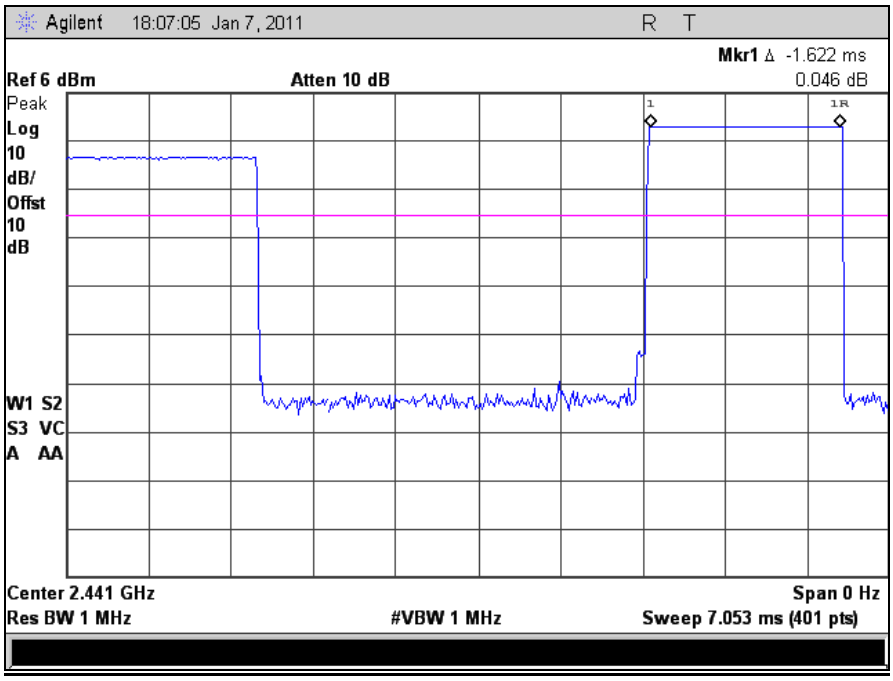
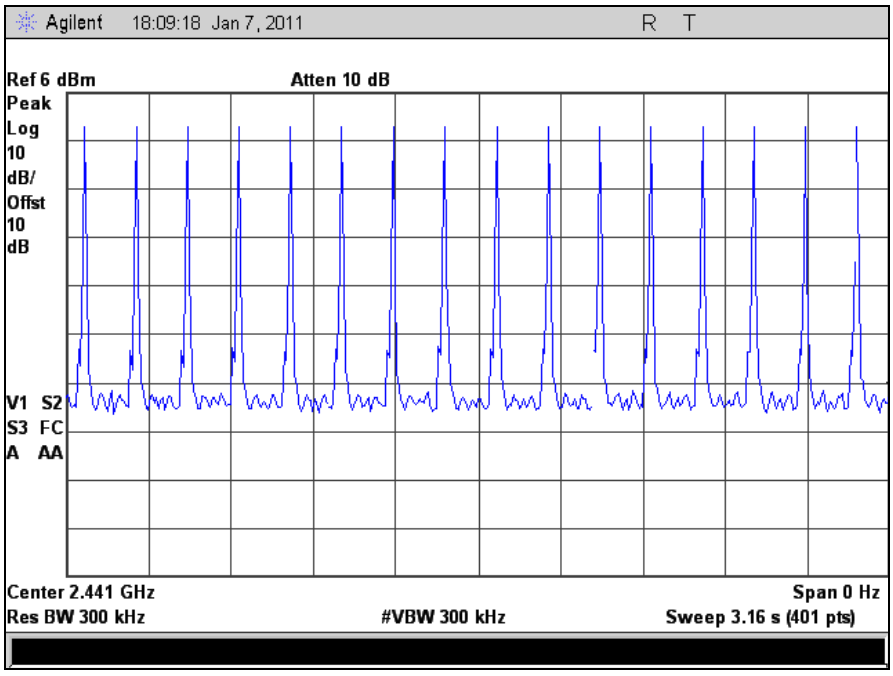
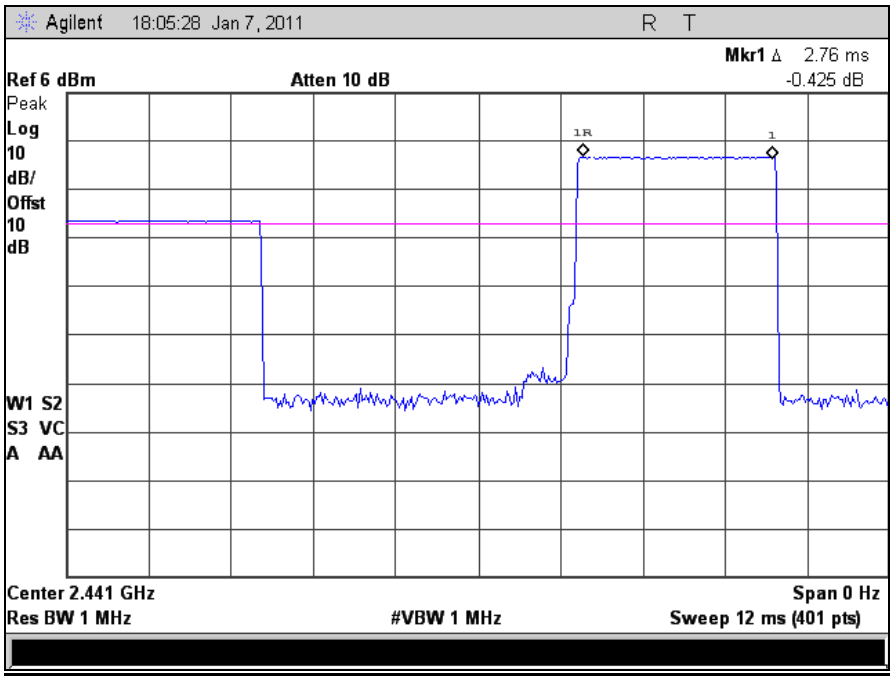


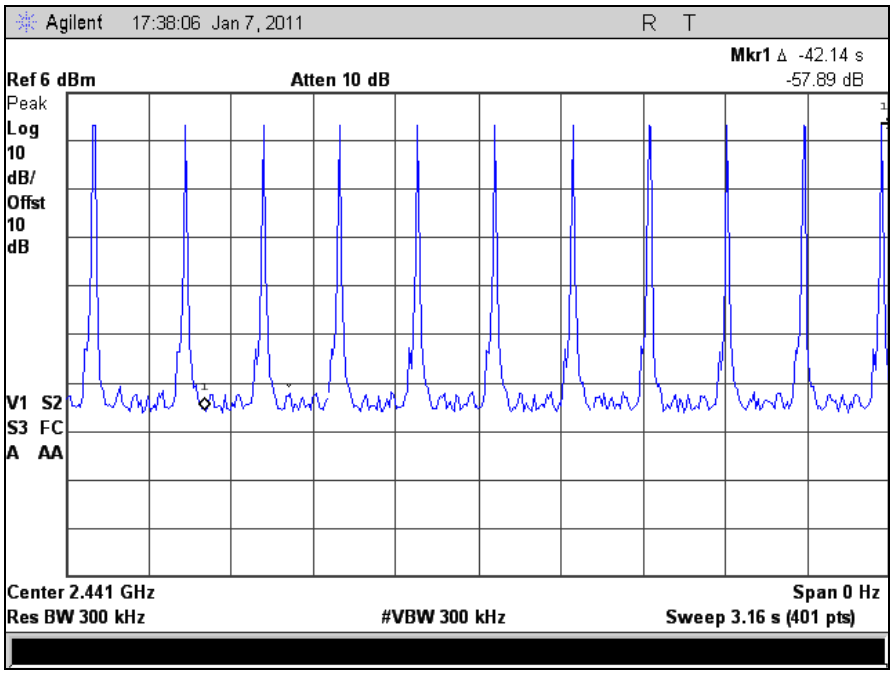
Plot 28. DH3, Pulse Width



Plot 29. DH3, Number of Times a Channel is Repeated in a 3.16 second Period



Plot 30. DH5, Pulse Width



Plot 31. DH5, Number of Times a Channel is Repeated in a 3.16 second Period

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Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(b) Peak Power Output and RF Exposure

Test Requirements:

§15.247(b)(1): The maximum peak output power of the intentional radiator shall not exceed 0.125 Watts for frequency hopping systems operating in the 2400-2483.5 MHz band. .

§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, 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 and using a point to point application 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 transmitter was connected to a calibrated spectrum analyzer. The EUT was measured at the low, mid and high channels of each band at the maximum power level.

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

Test Engineer(s): Lionel Gabrillo

Test Date(s): 1/10/11

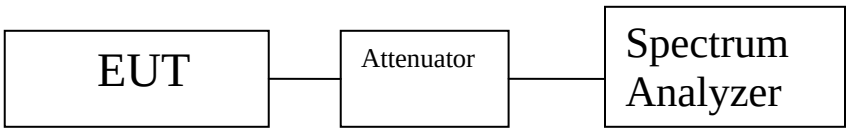


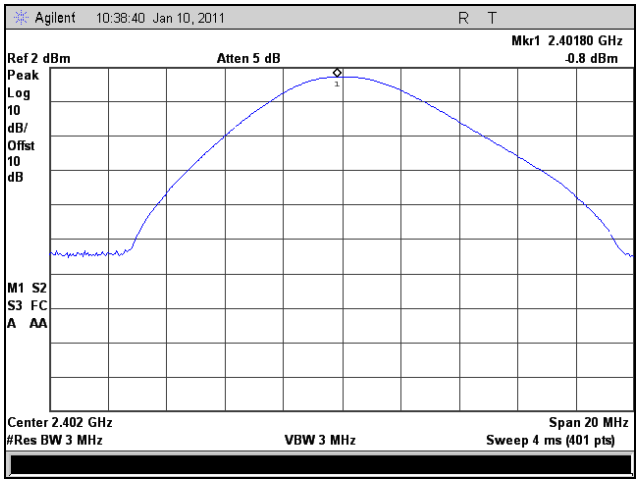
Figure 3. Peak Power Output Test Setup

RF Power Output Test Results

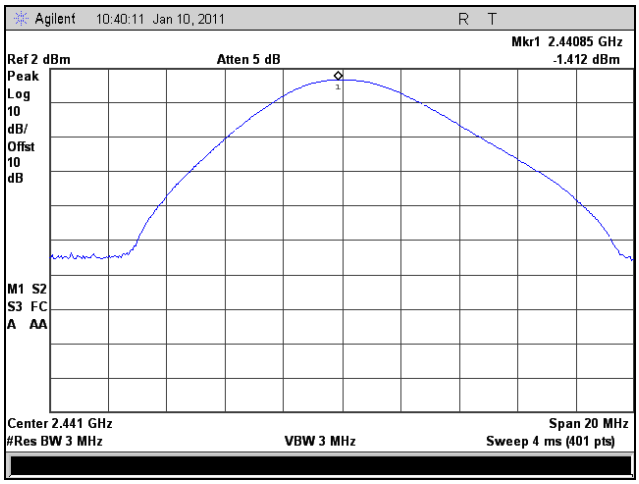
Peak Conducted Output Power		
Carrier Channel	**Frequency (MHz)**	**Measured Peak Output Power dBm**
Low	2402	-0.8
Mid	2441	-1.412
High	2480	-1.764

Table 24. RF Output Power Test Results

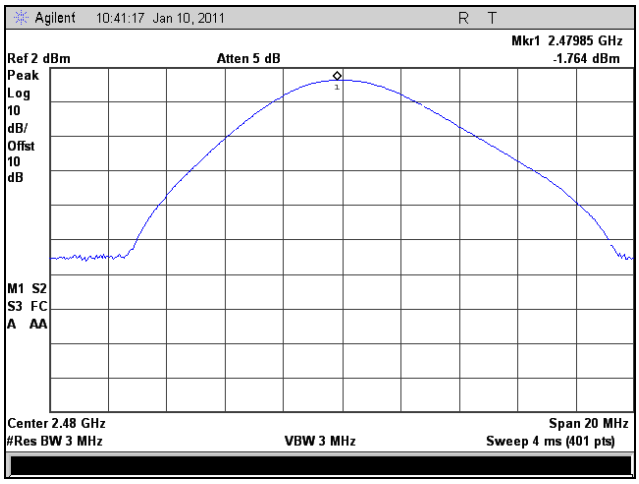
RF Output Power Test Results



Plot 32. Peak Output Power, Low Channel



Plot 33. Peak Output Power, Mid Channel



Plot 34. Peak Output Power, High Channel

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Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(b) RF Exposure

RF Exposure Requirements: **§1.1307(b)(1) and §1.1307(b)(2):** Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

RF Radiation Exposure Limit: **§1.1310:** As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

MPE Limit Calculation: EUT's operating frequencies @ 2400-2483.5 MHz; highest conducted power = *16.18dBm* (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

EUT maximum antenna gain = *4 dBi.*

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

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

where, S = Power Density (1 mW/cm^2)
P = Power Input to antenna (41.4mW)
G = Antenna Gain (63.1 numeric)

S = (0.83*2.51 / 4*3.14*20.0^2)= (2.089/ 5024) = **0.00042mW/cm^2**@ 20cm separation

Electromagnetic Compatibility Criteria for Intentional Radiators

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

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

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

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

MHz	MHz	MHz	GHz
0.090–0.110----------	16.42–16.423	399.9–410	4.5–5.15
[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 25. 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 26.

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

Test Procedure: The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line. Only noise floor was measured above 18 GHz. All spurious emissions are measured with GFSK modulation which represents the worst case emission.

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

Test Engineer(s): Lionel Gabrillo

Test Date(s): 01/05/11

Harmonic Emissions Requirements – Radiated

Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg.)	P. Amp (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg.	Limit @ 3 m (dBuV/m)	Delta (dB)
4.804	V	55.92	34.76	33.99	5.07	60.22	Peak	74	-13.78
4.804	V	46.83	34.76	33.99	5.07	51.13	Avg.	54	-2.87*
7.206	V	42.61	35.00	36.75	6.23	50.58	Peak	74	-23.42
7.206	V	32.67	35.00	36.75	6.23	40.64	Avg.	54	-13.36
9.608	V	42.25	35.59	38.22	7.23	52.10	Peak	74	-21.90
9.608	V	32.56	35.59	38.22	7.23	42.41	Avg.	54	-11.59
12.01	V	40.65	35.02	39.83	9.44	54.90	Peak	74	-19.10
12.01	V	30.93	35.02	39.83	9.44	45.18	Avg.	54	-8.82

Table 27. Radiated Harmonic Emissions, Low Channel

Note: * - Noise Floor

Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg.)	P. Amp (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg.	Limit @ 3 m (dBuV/m)	Delta (dB)
4.882	V	55.6	34.74	34.20	5.06	60.12	Peak	74	-13.88
4.882	V	49.46	34.74	34.20	5.06	53.98	Avg.	54	-0.02*
7.323	V	41.6	35.03	37.00	6.34	49.91	Peak	74	-24.09
7.323	V	30.9	35.03	37.00	6.34	39.21	Avg.	54	-14.79
9.764	V	43.93	35.55	38.36	7.44	54.18	Peak	74	-19.82
9.764	V	31.35	35.55	38.36	7.44	41.60	Avg.	54	-12.40
12.205	V	41.7	34.93	39.74	9.14	55.65	Peak	74	-18.35
12.205	V	30.11	34.93	39.74	9.14	44.06	Avg.	54	-9.94

Table 28. Radiated Harmonic Emissions, Mid Channel

Note: * - Noise Floor

Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg.)	P. Amp (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg.	Limit @ 3 m (dBuV/m)	Delta (dB)
4.96	V	55.26	34.72	34.39	5.06	59.99	Peak	74	-14.01
4.96	V	49.16	34.72	34.39	5.06	53.89	Avg.	54	-0.11
7.44	V	40.95	35.08	37.21	6.41	49.49	Peak	74	-24.51
7.44	V	29.84	35.08	37.21	6.41	38.38	Avg.	54	-15.62
9.92	V	43.27	35.54	38.51	7.62	53.86	Peak	74	-20.14
9.92	V	30.84	35.54	38.51	7.62	41.43	Avg.	54	-12.57
12.4	V	41.1	34.69	39.72	8.63	54.76	Peak	74	-19.24
12.4	V	29.13	34.69	39.72	8.63	42.79	Avg.	54	-11.21

Table 29. Radiated Harmonic Emissions, High Channel

Note: * - Noise Floor

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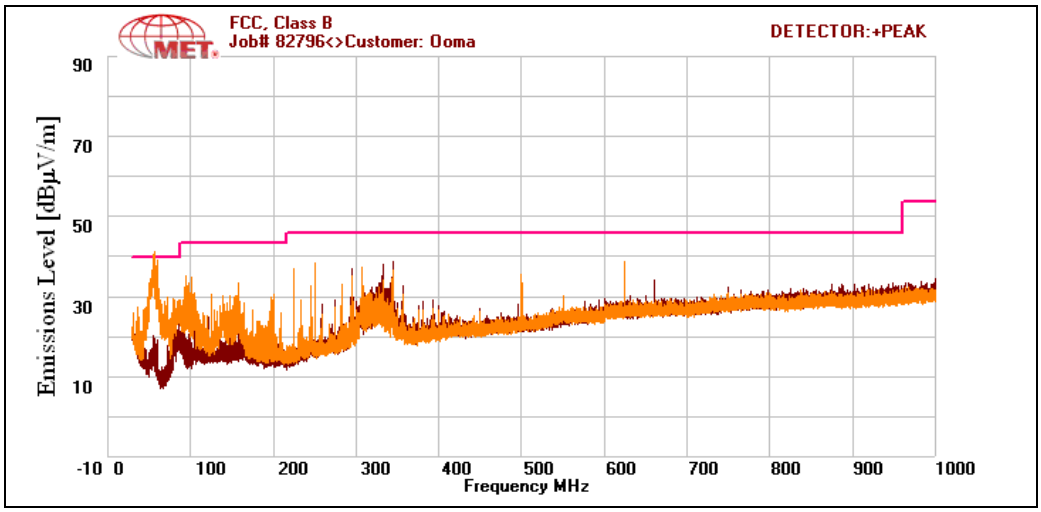
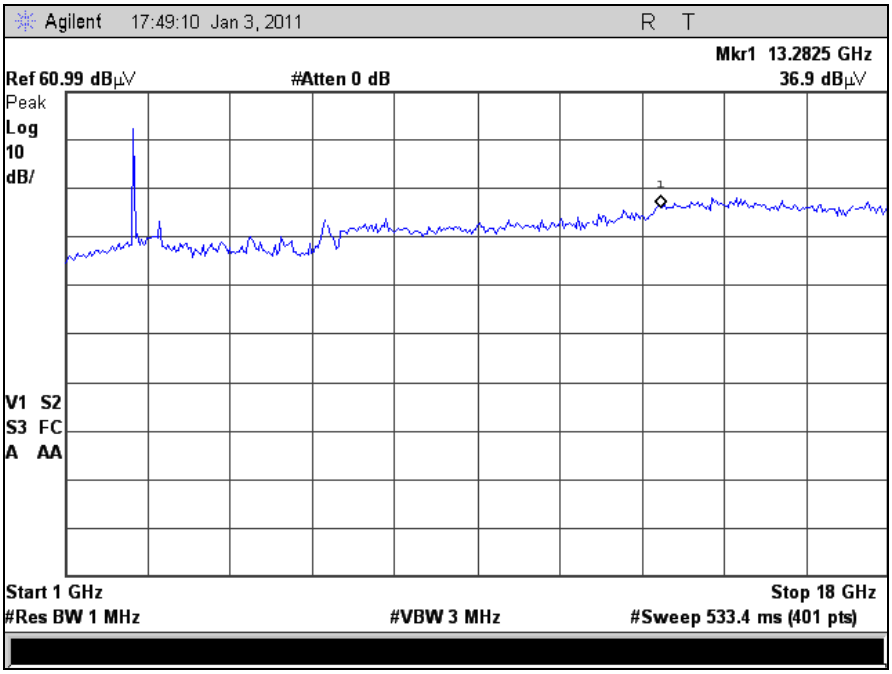
Radiated Spurious Emissions Test Results



Plot 35. Radiated Spurious Emissions, Low Channel, 30 MHz – 1 GHz



Plot 36. Radiated Spurious Emissions, Low Channel, 1 GHz – 18 GHz

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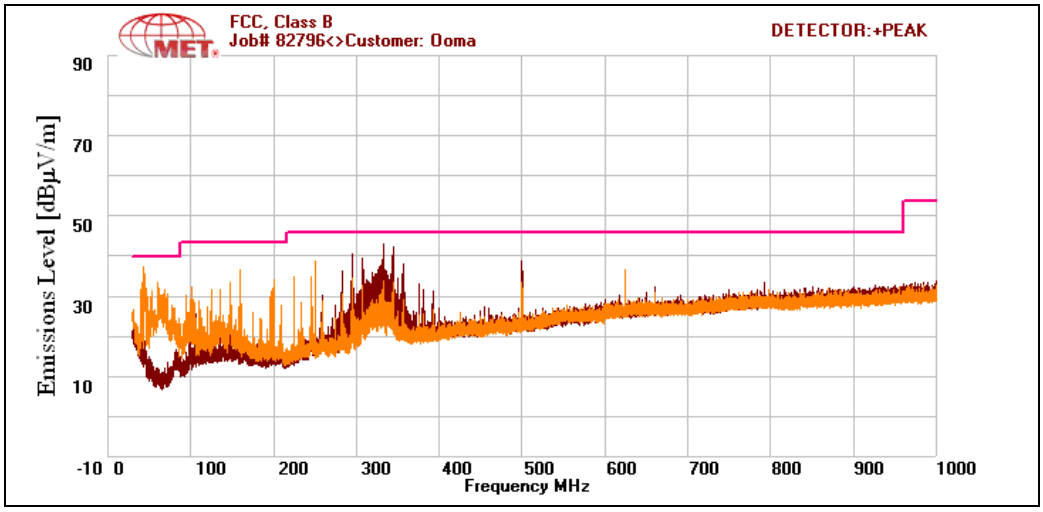
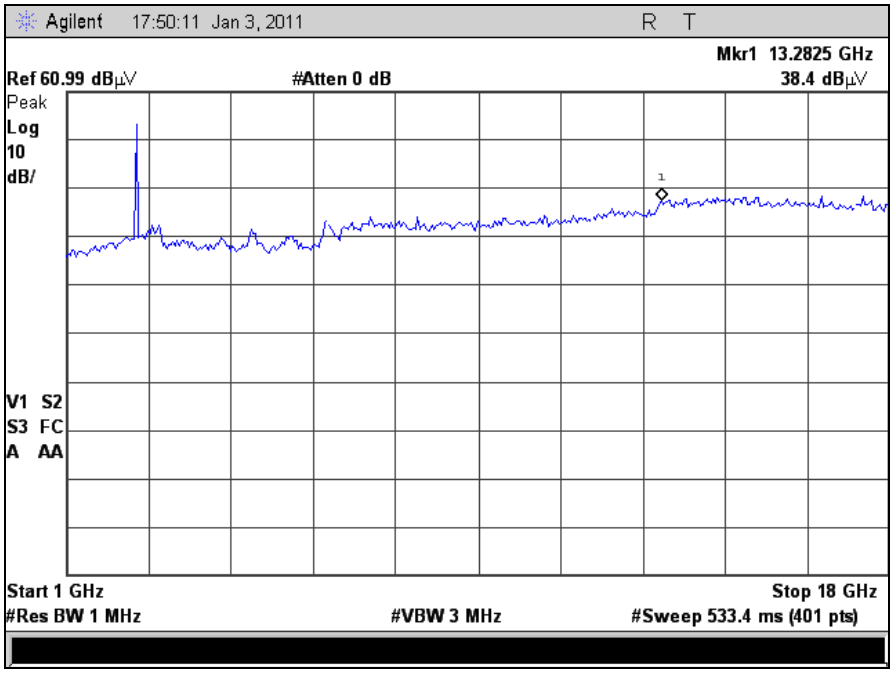


Plot 37. Radiated Spurious Emissions, Mid Channel, 30 MHz – 1 GHz



Plot 38. Radiated Spurious Emissions, Mid Channel, 1 GHz – 18 GHz

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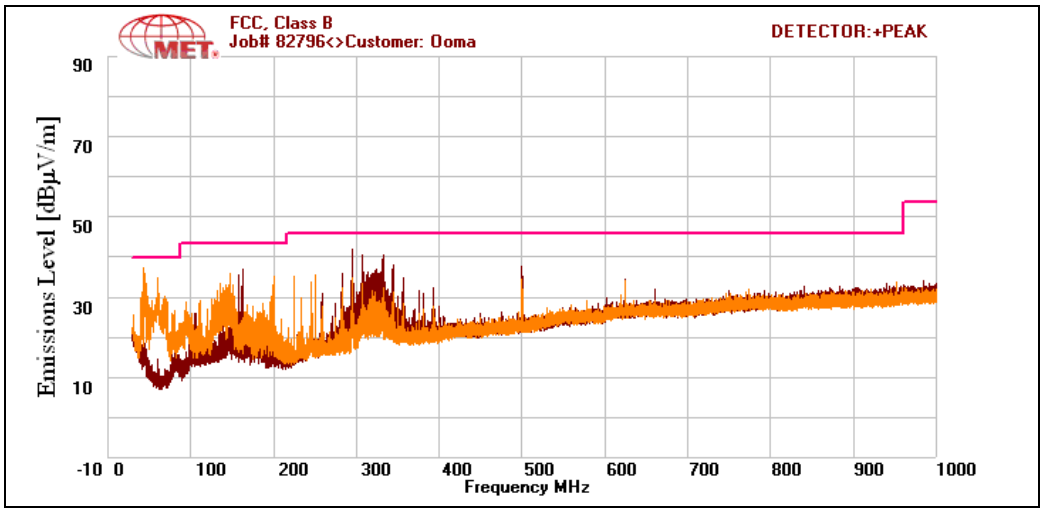
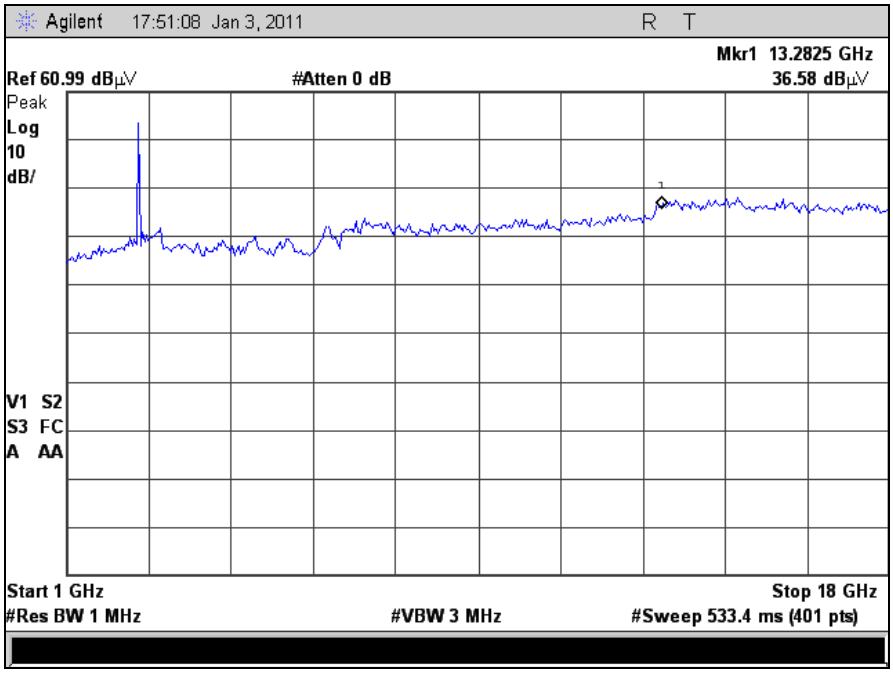


Plot 39. Radiated Spurious Emissions, High Channel, 30 MHz – 1 GHz



Plot 40. Radiated Spurious Emissions, High Channel, 1 GHz – 18 GHz

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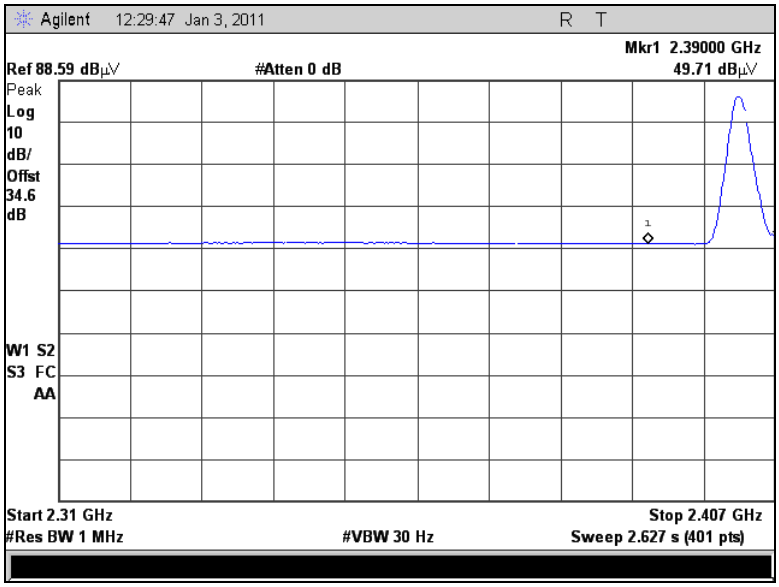
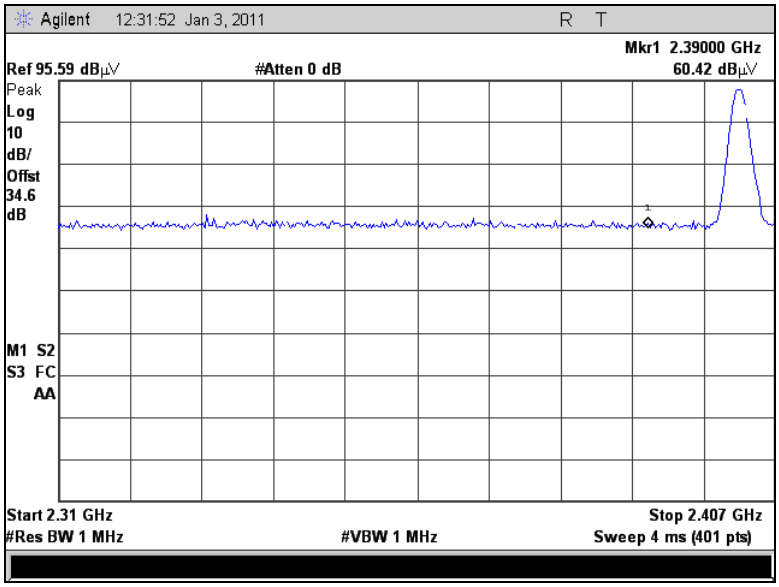
Radiated Band Edge Measurements

Test Procedures: The transmitter was tuned. Measurements were performed of the low and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for cable loss, antenna correction factor and distance.



Plot 41. Radiated Restricted Band Edge, Low Channel, Average



Plot 42. Radiated Restricted Band Edge, Low Channel, Peak

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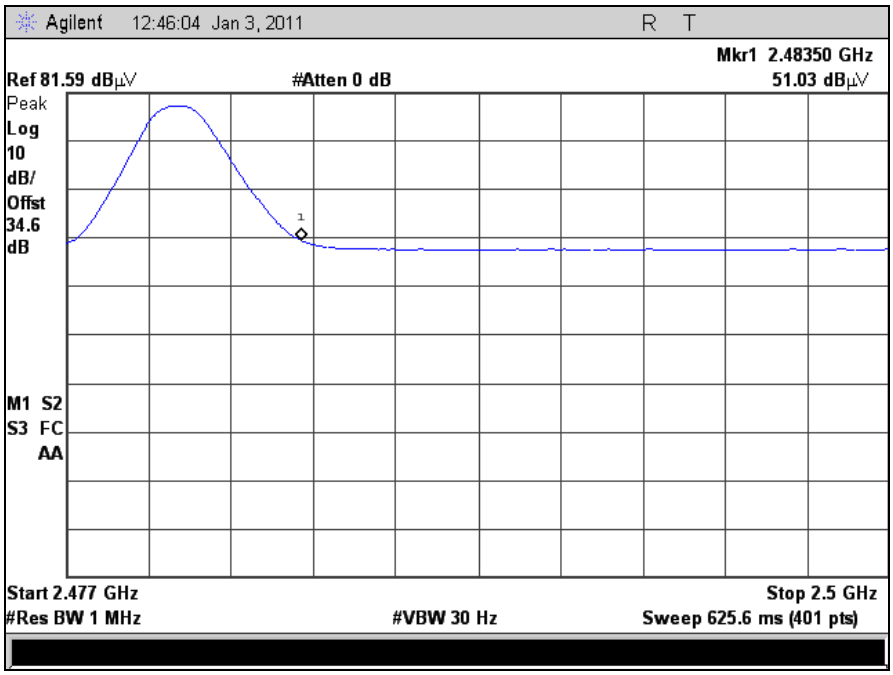
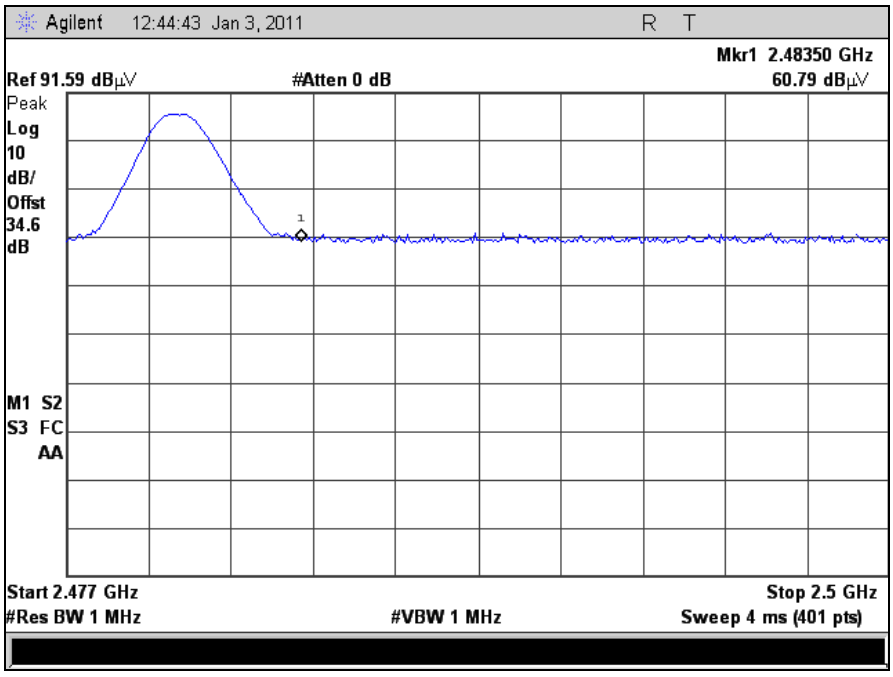


Plot 43. Radiated Restricted Band Edge, High Channel, Average



Plot 44. Radiated Restricted Band Edge, High Channel, Peak

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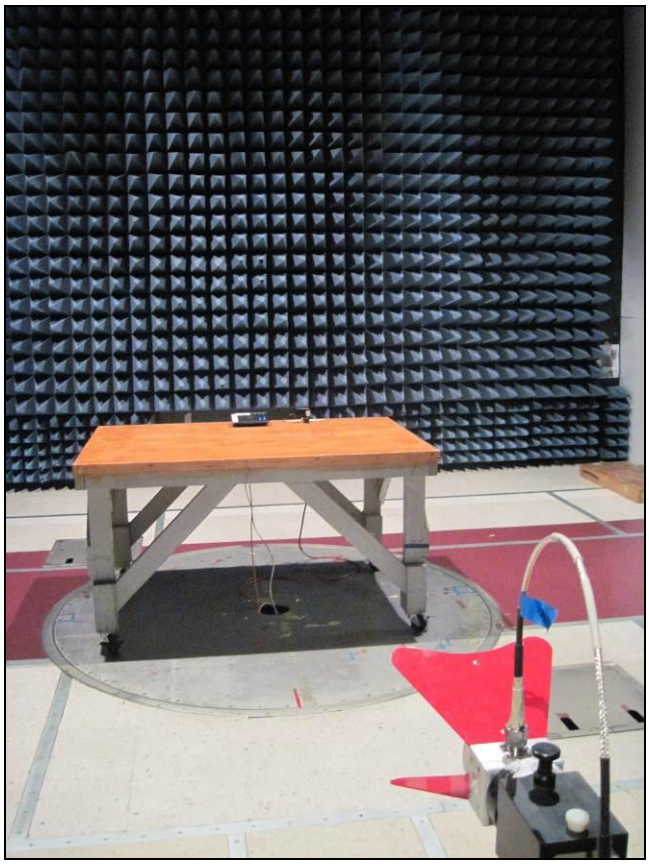
Radiated Spurious Emissions Test Setup



Photograph 6. Radiated Spurious Emissions, Test Setup

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Electromagnetic Compatibility Criteria for Intentional Radiators

RSS-GEN Receiver Spurious Emissions Requirements

Test Requirements: The following receiver spurious emission limits shall be complied with:

(a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 30.

Spurious Frequency (MHz)	Field Strength (microvolt/m at 3 metres)
30 – 88	100
88 – 216	150
216 – 960	200
Above 960	500

Table 30. Spurious Emission Limits for Receivers

(b) If a conducted measurement is made, no spurious output signals appearing at the antenna terminals shall exceed 2 nanowatts per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5 nanowatts above 1 GHz.

Test Procedures: The EUT was programmed for receive mode only. Conducted measurements were taken at the antenna port of the EUT. 100 kHz resolution bandwidth was used from 30 MHz - 1 GHz and 300 kHz resolution was used for measurements done above 1 GHz. All plots are corrected for cable loss.

Test Results: The EUT was compliant with this requirement. The receiver spurious emissions were tested conducted.

Test Engineer(s): Lionel Gabrillo

Test Date(s): January 03, 2011

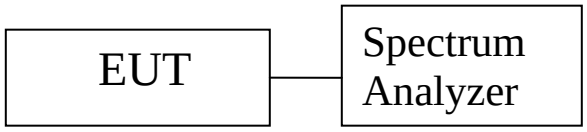
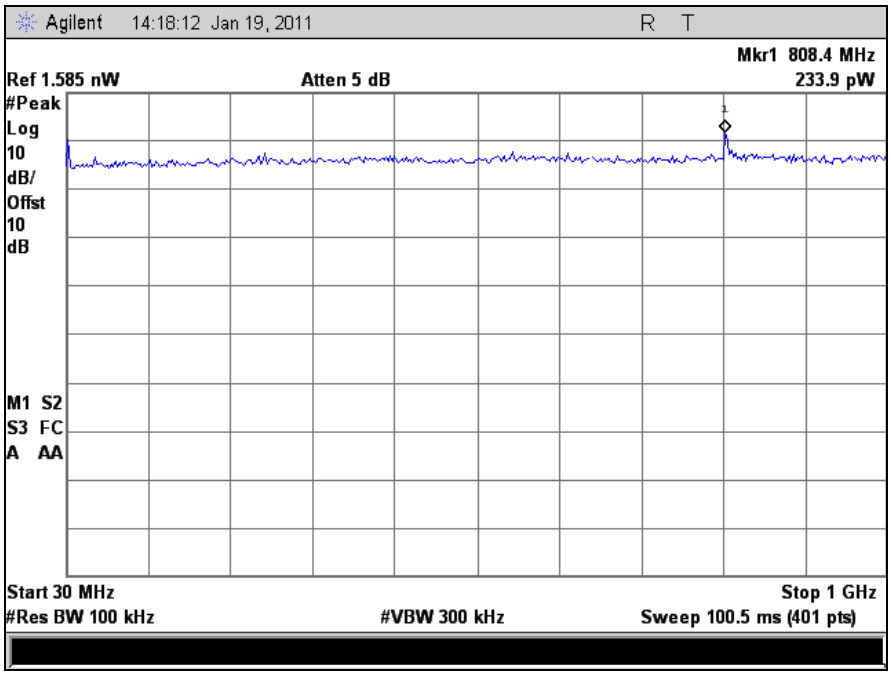
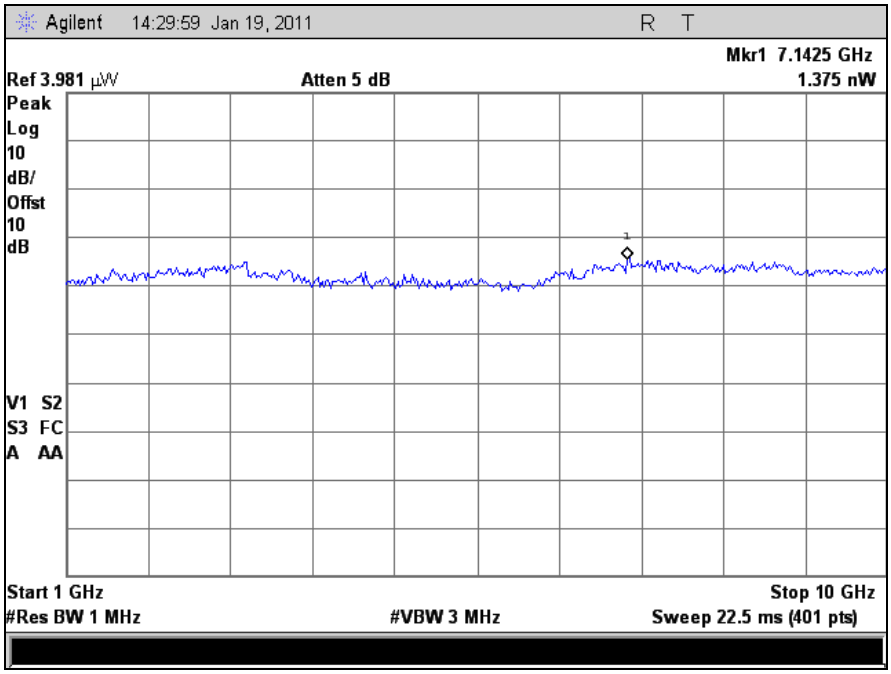


Figure 4. Block Diagram, Conducted Receiver Spurious Emissions Test Setup

Conducted Receiver Spurious Emissions



Plot 45. Receiver Spurious Emission, 30 MHz – 1 GHz



Plot 46. Receiver Spurious Emission, 1 GHz – 18 GHz

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Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) RF Conducted Spurious Emissions Requirements and Band Edge

Test Requirement: **15.247(d)** In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

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

See following pages for detailed test results with RF Conducted Spurious Emissions. All spurious emissions are measured with GFSK modulation which represents the worst case emission.

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

Test Engineer(s): Lionel Gabrillo

Test Date(s): 01/07/11

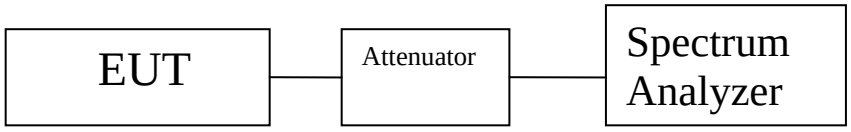
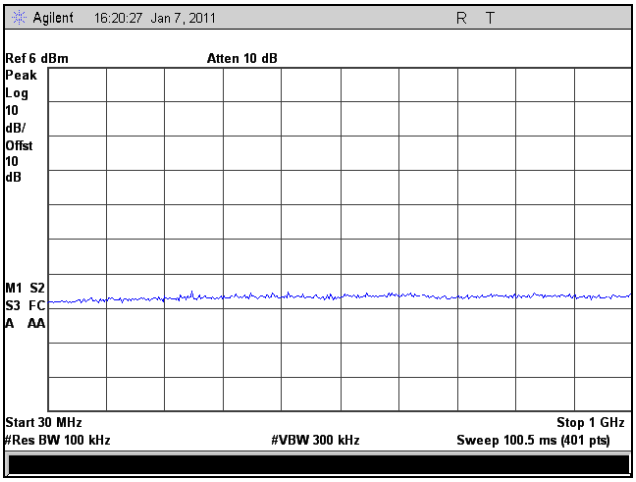
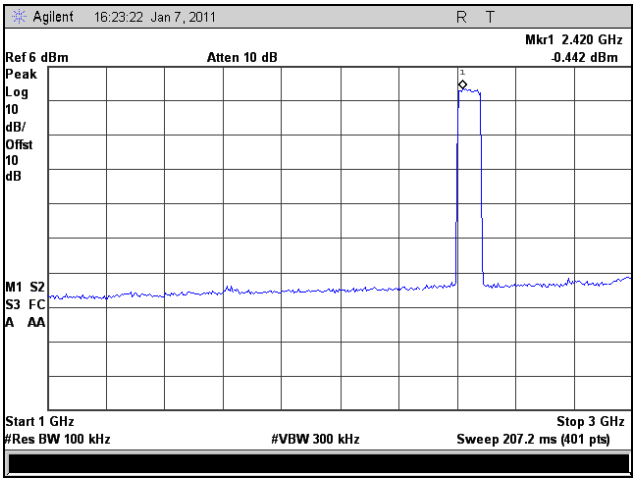


Figure 5. Block Diagram, Conducted Spurious Emissions Test Setup

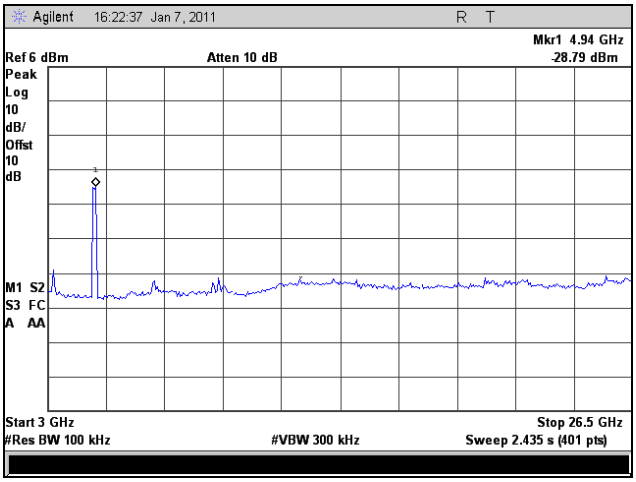
Conducted Spurious Emissions Test Results



Plot 47. Conducted Emissions, 30 MHz – 1 GHz



Plot 48. Conducted Emissions, 1 GHz – 3 GHz



Plot 49. Conducted Emissions, 3 GHz – 26.5 GHz

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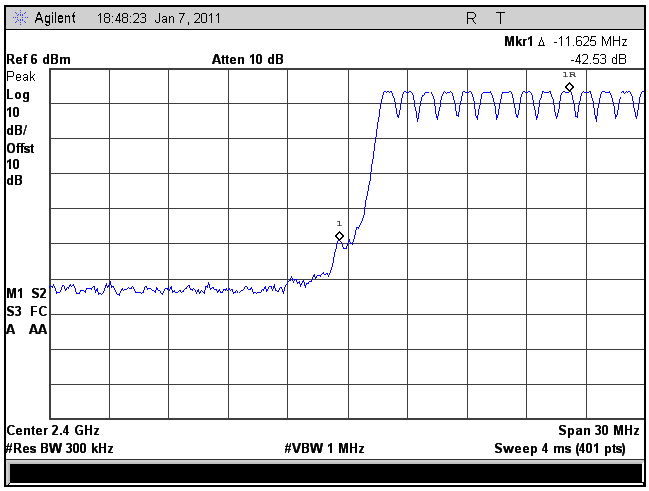
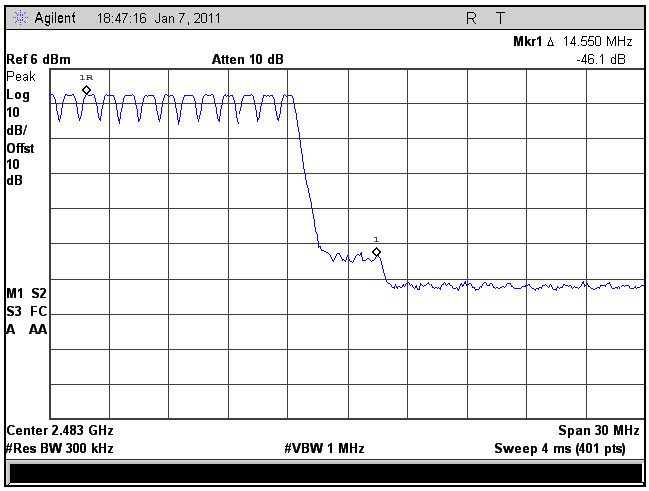
Conducted Band Edge Test Results



Plot 50. Conducted Band Edge, Low



Plot 51. Conducted Band Edge, High

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IV. Test Equipment

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Test Equipment

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

MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1S2501	EMI RECEIVER	ROHDE&SCHWARZ	ESU40	06/03/2010	06/03/2011
1S2484	BILOG ANTENNA	TESEQ	CBL6112D	SEE NOTE	
1S2399	TURNNTABLE CONTROLLER	SUNOL SCIENCE	SC99V	NOT REQUIRED	
1S2522	DIGITAL THERMO/HYGROMETER	CONTROL COMPANY	11-661-7D	11/11/2009	11/11/2010
1S2482	5M CHAMBER	PANASHIELD	N/A	10/16/2009	10/16/2010
1S2603	DOUBLE RIDGED WAVEGUIDE HORN	ETS-LINGREN	3117	04/09/2009	04/09/2011
1S2121	PRE-AMPLIFIER	HEWLETT PACKARD	8449B	SEE NOTE	
1S2512	TRANSIENT LIMITER	AGILENT	11947A	SEE NOTE	
N/A	HIGH PASS FILTER	MICRO-TRONICS	HPM13146	SEE NOTE	
1S2034	COUPLER, DIRECTIONAL 1-20 GHZ	KRYTAR	101020020	SEE NOTE	
1S2583	SPECTRUM ANALYZER	AGILENT	E4447A	01/26/2010	01/26/2011
1S2460	ANALYZER, SPECTRUM 9 KHZ-40GHZ	AGILENT	E4407B	07/13/2010	07/13/2011
1S2229	TEMPERATURE CHAMBER	TENNY ENGINEERING	T63C	02/19/2010	02/19/2011
1S2630	TRANSIENT LIMITER	FISCHER CUSTOM COMMUNICATIONS	FCC-450B-2.4-N	01/24/2010	01/24/2011
1S2128	HARMONIC MIXER	HEWLETT PACKARD	11970A	11/22/2008	11/22/2010
1S2501	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU40	06/03/2010	06/03/2011
1S2488	SCREEN ROOM	UNIVERSAL	CUSTOM MADE	01/20/2010	01/20/2011
1S2507	LISN	SOLAR ELECTRONICS	9252-50-R-24-BNC	08/06/2010	08/06/2011
1S2129	HARMONIC MIXER	HEWLETT PACKARD	11970K	11/22/2008	11/22/2010

Table 31. Test Equipment List

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

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V. Certification & User's Manual Information

Certification & User's Manual Information

A. Certification Information

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

§ 2.801 Radio-frequency device defined.

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

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

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

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

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

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

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

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

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

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

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(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.

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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.

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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 user's 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.

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End of Report

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