



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

33439 WESTERN AVENUE • UNION CITY, CALIFORNIA 94587 • PHONE (510) 489-6300 • FAX (510) 489-6372

3162 BELICK STREET • SANTA CLARA, CA 95054 • PHONE (408) 748-3585 • FAX (510) 489-6372

13501 MCCALLEN PASS • AUSTIN, TEXAS 78753 • PHONE (512) 287-2500 • FAX (512) 287-2513

May 29, 2015

AKRAPOVIC d.d.
Malo Hudo 8a
Ivancna Gorica, Slovenia 1295

Dear Melita Kotnik,

Enclosed is the EMC Wireless test report for compliance testing of the AKRAPOVIC d.d., Akrapovic Sound Kit/Sound Receiver (P-HF841) as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 15, Subpart C and 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: (\AKRAPOVIC d.d.\EMC85444B-FCC247 Rev. 2)

Certificates and reports shall not be reproduced except in full, without the written permission of MET Laboratories, Inc.

Electromagnetic Compatibility Criteria Test Report

for the

**AKRAPOVIC d.d.
Akrapovic Sound Kit/Sound Receiver (P-HF841)**

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Part 15.247 Subpart C
&
RSS-210, Issue 8, Dec. 2010
for Intentional Radiators

MET Report: EMC85444B-FCC247 Rev. 2

May 29, 2015

Prepared For:

**AKRAPOVIC d.d.
Malo Hudo 8a
Ivancna Gorica, Slovenia 1295**

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

**Electromagnetic Compatibility Criteria
Test Report**

for the

**AKRAPOVIC d.d.
Akrapovic Sound Kit/Sound Receiver (P-HF841)**

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Part 15.247 Subpart C
&
RSS-210, Issue 8, Dec. 2010
for Intentional Radiators



Benjamin Taylor, 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 Part 15.247 and Industry Canada standard RSS-210, Issue 8, Dec. 2010 under normal use and maintenance.



Asad Bajwa,
Director, Electromagnetic Compatibility Lab



AKRAPOVIC d.d.

Akrapovic Sound Kit/Sound Receiver (P-HF841)

Electromagnetic Compatibility

Report Status

CFR Title 47, Part 15.247; RSS-210, Issue 8, Dec. 2010

Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	May 7, 2015	Initial Issue.
1	May 14, 2015	Editorial corrections.
2	May 29, 2015	Engineer corrections.

Table of Contents

I.	Executive Summary	1
	A. Purpose of Test	2
	B. Executive Summary	2
II.	Equipment Configuration	3
	A. Overview.....	4
	B. References.....	5
	C. Test Site	5
	D. Description of Test Sample.....	5
	E. Mode of Operation.....	6
	F. Method of Monitoring EUT Operation.....	6
	G. Modifications	6
	a) Modifications to EUT.....	6
	b) Modifications to Test Standard.....	6
	H. Disposition of EUT	6
III.	Electromagnetic Compatibility Criteria for Intentional Radiators.....	7
	§ 15.203 Antenna Requirement	8
	§ 15.207(a) Conducted Emissions Limits.....	9
	§ 15.247(a)(a) 6 dB and 99% Bandwidth	10
	§ 15.247(b) Peak Power Output	14
	§ 15.247(d) Radiated Spurious Emissions Requirements and Band Edge.....	16
	§ 15.247(d) RF Conducted Spurious Emissions Requirements and Band Edge.....	24
	§ 15.247(e) Peak Power Spectral Density	27
	§ 15.247(i) Maximum Permissible Exposure	29
IV.	Test Equipment	30
V.	Certification & User's Manual Information	32
	A. Certification Information	33
	B. Label and User's Manual Information	37
VI.	ICES-003 Procedural & Labeling Requirements.....	39

List of Tables

Table 1. Executive Summary of EMC Part 15.247 Compliance Testing	2
Table 2. EUT Summary Table.....	4
Table 3. References	5
Table 4. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)	9
Table 5. 6 dB Occupied Bandwidth, Test Results	11
Table 6. 99% Occupied Bandwidth, Test Results	11
Table 7. Output Power Requirements from §15.247(b)	14
Table 8. Peak Power Output, Test Results	14
Table 9. Restricted Bands of Operation.....	16
Table 10. Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a)	17
Table 11. Peak Power Spectral Density, Test Results	27
Table 12. Test Equipment List	31

List of Plots

Plot 1. 6 dB Occupied Bandwidth, Low Channel.....	12
Plot 2. 6 dB Occupied Bandwidth, Mid Channel	12
Plot 3. 6 dB Occupied Bandwidth, High Channel	12
Plot 4. 99% Occupied Bandwidth, Low Channel	13
Plot 5. 99% Occupied Bandwidth, Mid Channel.....	13
Plot 6. 99% Occupied Bandwidth, High Channel	13
Plot 7. Peak Power Output, Low Channel	15
Plot 8. Peak Power Output, Mid Channel.....	15
Plot 9. Peak Power Output, High Channel	15
Plot 10. Radiated Spurious Emissions, Low Channel, 30 MHz – 1 GHz.....	18
Plot 11. Radiated Spurious Emissions, Low Channel, 1 GHz – 18 GHz, Average	18
Plot 12. Radiated Spurious Emissions, Low Channel, 1 GHz – 18 GHz, Peak.....	18
Plot 13. Radiated Spurious Emissions, Mid Channel, 30 MHz – 1 GHz	19
Plot 14. Radiated Spurious Emissions, Mid Channel, 1 GHz – 18 GHz, Average.....	19
Plot 15. Radiated Spurious Emissions, Mid Channel, 1 GHz – 18 GHz, Peak	19
Plot 16. Radiated Spurious Emissions, High Channel, 30 MHz – 1 GHz	20
Plot 17. Radiated Spurious Emissions, High Channel, 1 GHz – 18 GHz, Average	20
Plot 18. Radiated Spurious Emissions, High Channel, 1 GHz – 18 GHz, Peak	20
Plot 19. Radiated Restricted Band Edge, Low Channel, Average.....	21
Plot 20. Radiated Restricted Band Edge, Low Channel, Peak	21
Plot 21. Radiated Restricted Band Edge, High Channel, Average	22
Plot 22. Radiated Restricted Band Edge, High Channel, Peak.....	22
Plot 23. Conducted Spurious Emissions, Low Channel, 30 MHz – 25 GHz.....	25
Plot 24. Conducted Spurious Emissions, Mid Channel, 30 MHz – 25 GHz	25
Plot 25. Conducted Spurious Emissions, High Channel, 30 MHz – 25 GHz	25
Plot 26. Conducted Band Edge, Low Channel	26
Plot 27. Conducted Band Edge, High Channel	26
Plot 28. Peak Power Spectral Density, Low Channel.....	28
Plot 29. Peak Power Spectral Density, Mid Channel	28
Plot 30. Peak Power Spectral Density, High Channel	28

List of Figures

Figure 1. Block Diagram, Occupied Bandwidth Test Setup.....	10
Figure 2. Peak Power Output Test Setup.....	14
Figure 3. Block Diagram, Conducted Spurious Emissions Test Setup.....	24
Figure 4. Block Diagram, Peak Power Spectral Density Test Setup	27

List of Photographs

Photograph 1. EUT (Receiver, Vehicle Mounted)	6
Photograph 2. Radiated Spurious Emissions, 30 MHz – 1 GHz Test Setup.....	23
Photograph 3. Radiated Spurious Emissions, 1 GHz – 18 GHz Test Setup	23

List of Terms and Abbreviations

AC	Alternating Current
ACF	Antenna Correction Factor
Cal	Calibration
<i>d</i>	Measurement Distance
dB	Decibels
dB μ A	Decibels above one microamp
dB μ V	Decibels above one microvolt
dB μ A/m	Decibels above one microamp per meter
dB μ V/m	Decibels above one microvolt per meter
DC	Direct Current
E	Electric Field
DSL	Digital Subscriber Line
ESD	Electrostatic Discharge
EUT	Equipment Under Test
<i>f</i>	Frequency
FCC	Federal Communications Commission
GRP	Ground Reference Plane
H	Magnetic Field
HCP	Horizontal Coupling Plane
Hz	Hertz
IEC	International Electrotechnical Commission
kHz	kilohertz
kPa	kilopascal
kV	kilovolt
LISN	Line Impedance Stabilization Network
MHz	Megahertz
μ H	microhenry
μ	microfarad
μ s	microseconds
NEBS	Network Equipment-Building System
PRF	Pulse Repetition Frequency
RF	Radio Frequency
RMS	Root-Mean-Square
TWT	Traveling Wave Tube
V/m	Volts per meter
VCP	Vertical Coupling Plane

I. Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the AKRAPOVIC d.d. Akrapovic Sound Kit/Sound Receiver (P-HF841), 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 Akrapovic Sound Kit/Sound Receiver (P-HF841). AKRAPOVIC d.d. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Akrapovic Sound Kit/Sound Receiver (P-HF841), 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 AKRAPOVIC d.d., purchase order number VEM15-011. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference 47 CFR Part 15.247:2005	IC Reference RSS-210 Issue 8: 2010; RSS-GEN Issue 4: 2014	Description	Compliance
Title 47 of the CFR, Part 15 §15.203	N/A	Antenna Requirement	Compliant
Title 47 of the CFR, Part 15 §15.207(a)	RSS-GEN (7.2.4)	Conducted Emission Limits	Not Applicable – EUT is DC powered.
Title 47 of the CFR, Part 15 §15.247(a)(2)	RSS-Gen(4.6)	6dB Occupied Bandwidth	Compliant
		99% Occupied Bandwidth	Compliant
Title 47 of the CFR, Part 15 §15.247(b)	RSS-210(A8.4)	Peak Power Output	Compliant
Title 47 of the CFR, Part 15 §15.247(d); §15.209; §15.205	RSS-210(A8.5)	Radiated Spurious Emissions Requirements	Compliant
Title 47 of the CFR, Part 15 §15.247(d)	RSS-210(A8.5)	RF Conducted Spurious Emissions Requirements	Compliant
Title 47 of the CFR, Part 15 §15.247(d)	RSS-210(A8.5)	RF Conducted Band Edge	Compliant
Title 47 of the CFR, Part 15; §15.247(e)	RSS-210(A8.2)	Peak Power Spectral Density	Compliant
Title 47 of the CFR, Part 15 §15.247(i)	RSS-Gen(5.6)	Maximum Permissible Exposure (MPE)	Compliant

Table 1. Executive Summary of EMC Part 15.247 Compliance Testing

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by AKRAPOVIC d.d. to perform testing on the Akrapovic Sound Kit/Sound Receiver (P-HF841), under AKRAPOVIC d.d.'s purchase order number VEM15-011.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the AKRAPOVIC d.d., Akrapovic Sound Kit/Sound Receiver (P-HF841).

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

Model(s) Tested:	Akrapovic Sound Kit/Sound Receiver (P-HF841)		
Model(s) Covered:	Akrapovic Sound Kit/Sound Receiver (P-HF841)		
EUT Specifications:	Primary Power: 12 VDC		
	FCC ID: 2AECJASR01 IC: 20099-ASR01		
	Type of Modulations:	Bluetooth low energy	
	Equipment Code:	DTS	
	Peak RF Output Power:	-1.39dBm	
	EUT Frequency Ranges:	2402-2480MHz	
Analysis:	The results obtained relate only to the item(s) tested.		
Environmental Test Conditions:	Temperature: 15-35° C		
	Relative Humidity: 30-60%		
	Barometric Pressure: 860-1060 mbar		
Evaluated by:	Benjamin Taylor		
Report Date(s):	May 29, 2015		

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
RSS-210, Issue 8, Dec. 2010	Low-power Licence-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment
RSS-GEN, Issue 4, Nov. 2014	General Requirements and Information for the Certification of Radio Apparatus
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
ISO/IEC 17025:2005	General Requirements for the Competence of Testing and Calibration Laboratories
ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices
KDB 558074 D01	DTS Measurement Guidance v03r02

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 AKRAPOVIC d.d. Akrapovic Sound Kit/Sound Receiver (P-HF841), Equipment Under Test (EUT), allows a driver to adjust the exhaust system valves with a simple push of a button while driving a vehicle, thereby choosing between a sporty deep sound of the Akrapovic exhaust system (open valves) and a regular sound (closed valves). The Akrapovic Sound kit consists of a Sound receiver placed near the exhaust system and the control button for triggering the receiver, which may be operated with the key fob or via mobile application.



Photograph 1. EUT (Receiver, Vehicle Mounted)

E. Mode of Operation

Normal operation mode:

RX receiver transmits data all the time (when powered). The measurement can be done with or without established connection with TX key fob.

F. Method of Monitoring EUT Operation

RX receiver transmits data all the time, there are no visible monitoring methods. LED indication serves only for establishing communication.

G. 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.

H. Disposition of EUT

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



III. Electromagnetic Compatibility Criteria for Intentional Radiators



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 Antenna Requirement

Test Requirement:

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

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

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

Results:

The EUT as tested is compliant the criteria of §15.203. The EUT employs an integrated antenna.

Test Engineer(s):

Benjamin Taylor

Test Date(s):

04/08/15

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 μ H/50 Σ line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency range (MHz)	§ 15.207(a), Conducted Limit (dB μ V)	
	Quasi-Peak	Average
* 0.15- 0.45	66 - 56	56 - 46
0.45 - 0.5	56	46
0.5 - 30	60	50

Table 4. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

Test Results: The EUT was compliant with this requirement. The EUT is DC powered.

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(a)(2) 6 dB and 99% Bandwidth

Test Requirements: § 15.247(a)(2): Operation under the provisions of this section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

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

Test Procedure: The transmitter was on and transmitting at the highest output power. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW=100 kHz, VBW > RBW. The 6 dB Bandwidth was measured and recorded. The measurements were performed on the low, mid and high channels.

Test Results The EUT was compliant with § 15.247 (a)(2).

The 6 dB and 99% Bandwidth was determined from the plots on the following pages.

Test Engineer(s): Benjamin Taylor

Test Date(s): 04/19/15



Figure 1. Block Diagram, Occupied Bandwidth Test Setup



Occupied Bandwidth Test Results

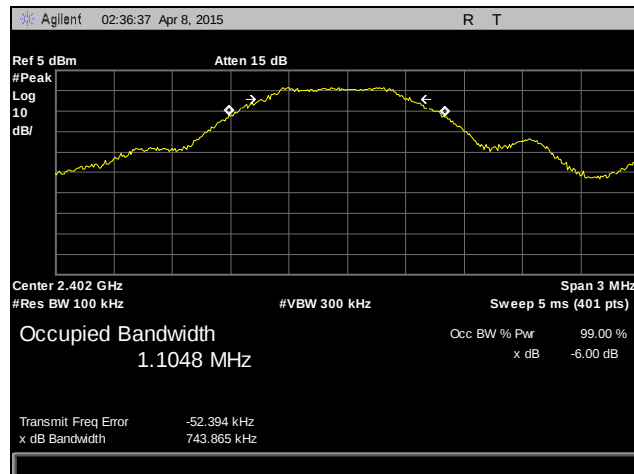
Occupied Bandwidth		
Carrier Channel	Frequency (MHz)	Measured 6 dB Bandwidth (kHz)
Low	2402	743.865
Mid	2440	741.790
High	2480	737.289

Table 5. 6 dB Occupied Bandwidth, Test Results

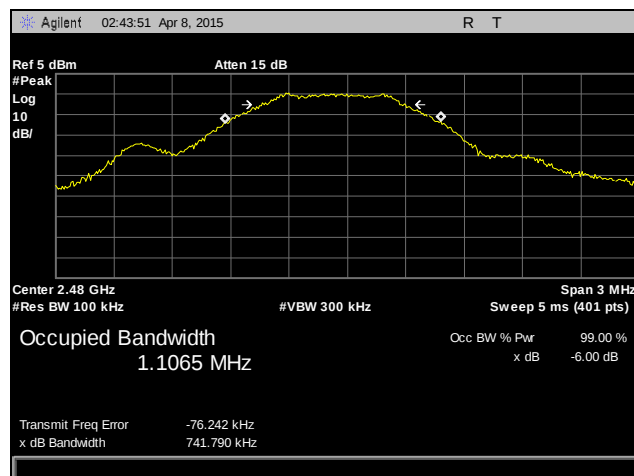
Occupied Bandwidth		
Carrier Channel	Frequency (MHz)	Measured 99% Bandwidth (MHz)
Low	2402	1.0782
Mid	2440	1.0713
High	2480	1.0565

Table 6. 99% Occupied Bandwidth, Test Results

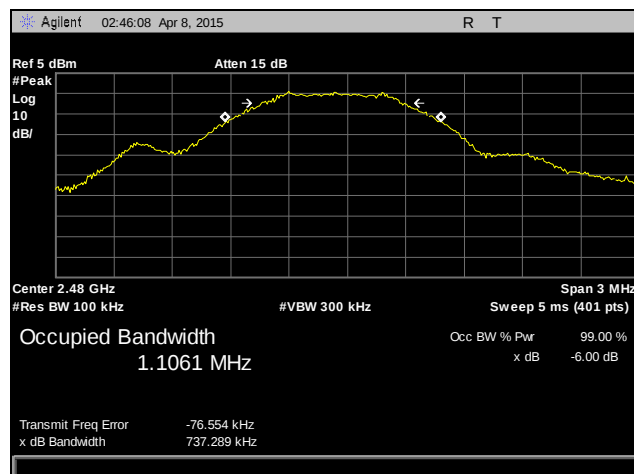
6 dB Occupied Bandwidth Test Results



Plot 1. 6 dB Occupied Bandwidth, Low Channel

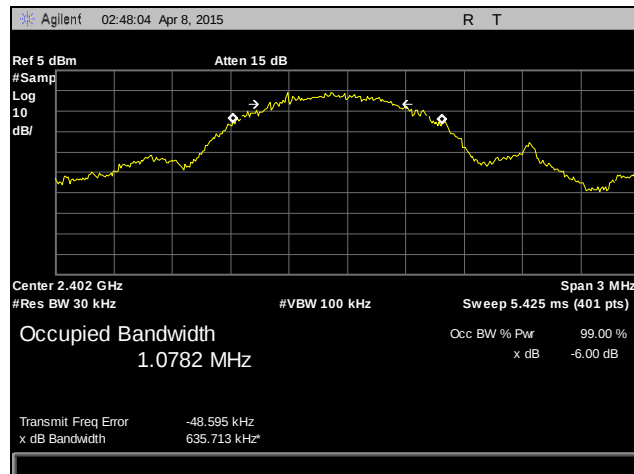


Plot 2. 6 dB Occupied Bandwidth, Mid Channel

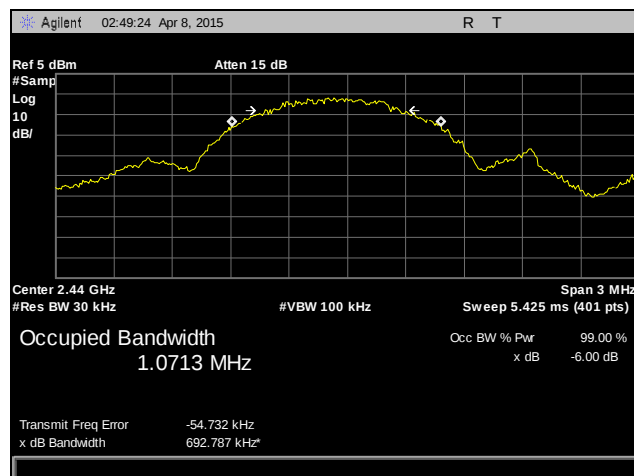


Plot 3. 6 dB Occupied Bandwidth, High Channel

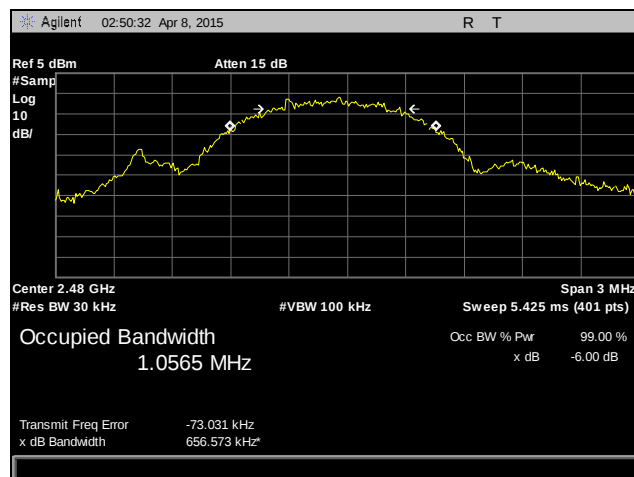
99% Occupied Bandwidth Test Results



Plot 4. 99% Occupied Bandwidth, Low Channel



Plot 5. 99% Occupied Bandwidth, Mid Channel



Plot 6. 99% Occupied Bandwidth, High Channel

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(b) Peak Power Output

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

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

Table 7. Output Power Requirements from §15.247(b)

§15.247(b)(4): The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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): Benjamin Taylor

Test Date(s): 04/19/15

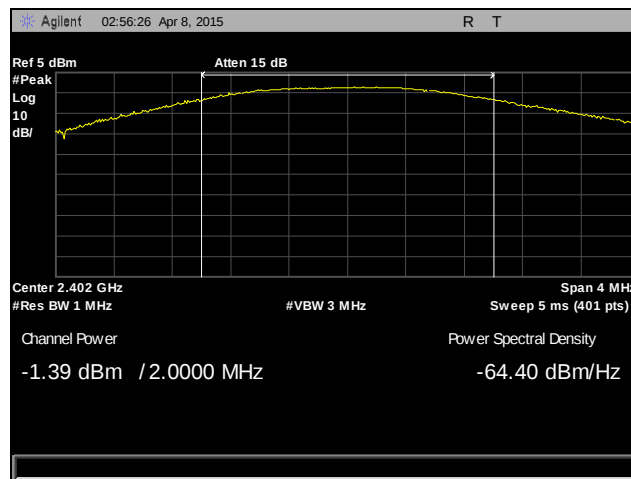


Figure 2. Peak Power Output Test Setup

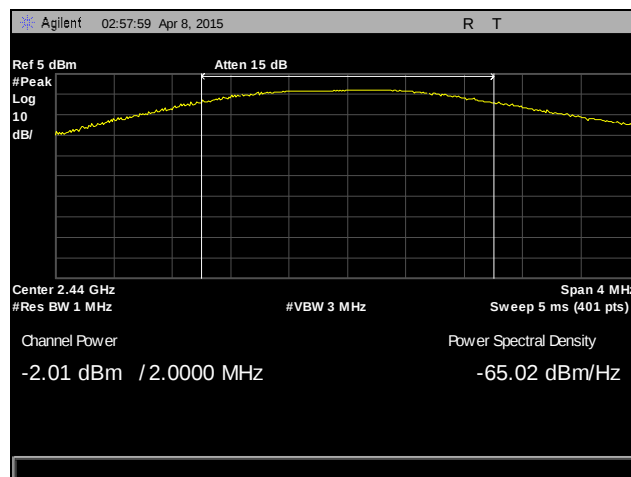
Peak Conducted Output Power		
Carrier Channel	Frequency (MHz)	Measured Peak Output Power (dBm)
Low	2402	-1.39
Mid	2440	-2.01
High	2480	-2.61

Table 8. Peak Power Output, Test Results

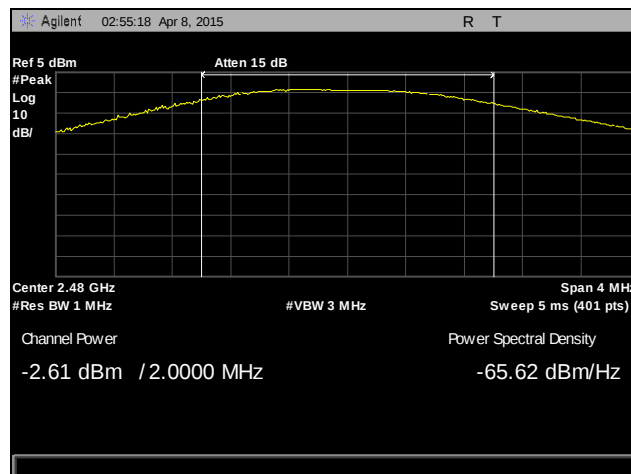
Peak Power Output Test Results



Plot 7. Peak Power Output, Low Channel



Plot 8. Peak Power Output, Mid Channel



Plot 9. Peak Power Output, High Channel

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.209(a) Radiated Spurious Emissions Requirements and Band Edge

Test Requirements: §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 9. 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 10.

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

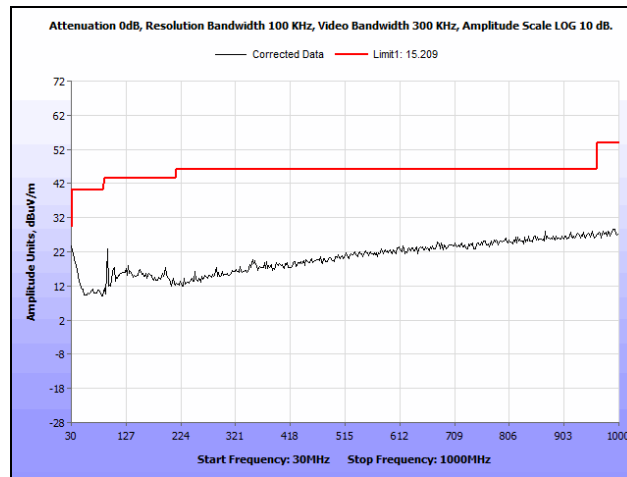
Test Procedures: The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line. Only noise floor was measured above 18 GHz.

Test Results: The EUT was compliant with the Radiated Spurious Emission limits of § 15.209(a).

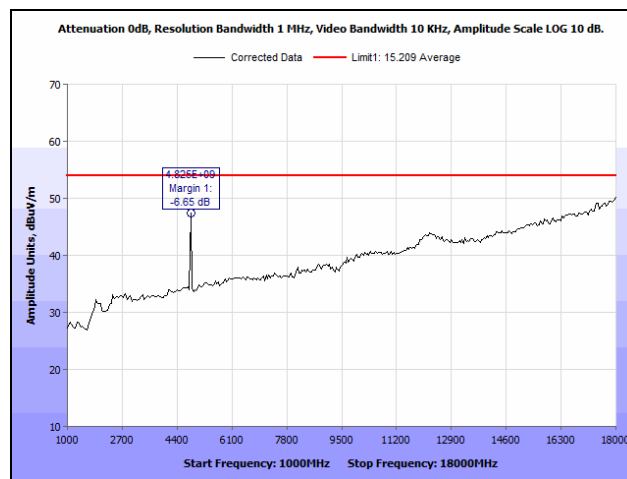
Test Engineer(s): Benjamin Taylor

Test Date(s): 04/19/15

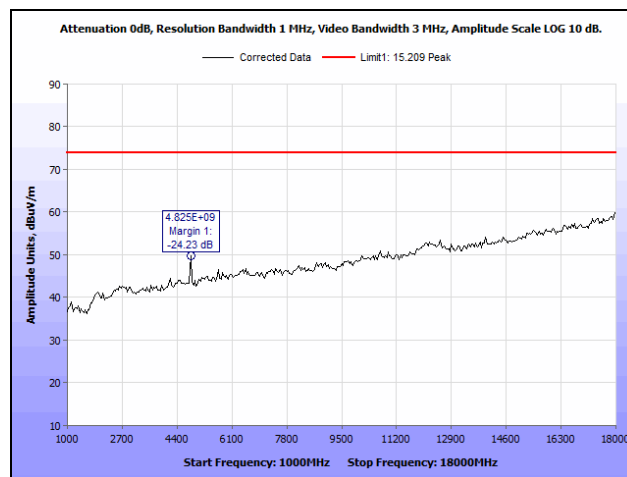
Radiated Spurious Emissions Test Results



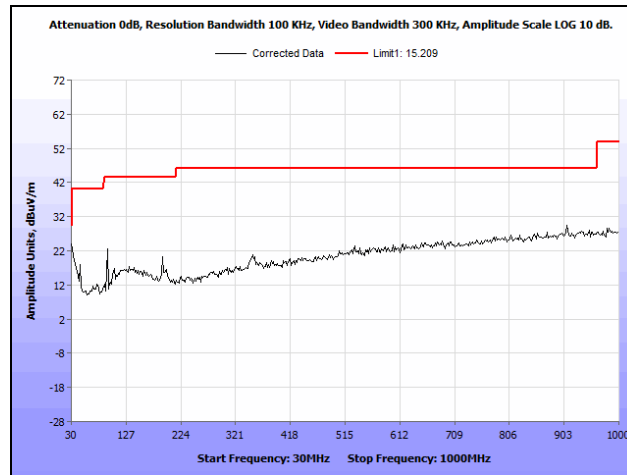
Plot 10. Radiated Spurious Emissions, Low Channel, 30 MHz – 1 GHz



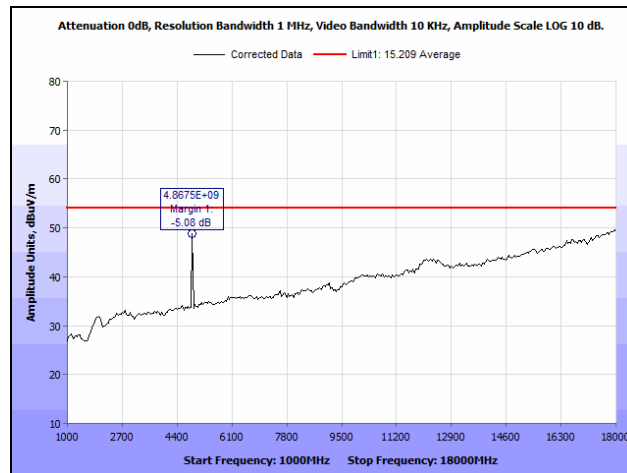
Plot 11. Radiated Spurious Emissions, Low Channel, 1 GHz – 18 GHz, Average



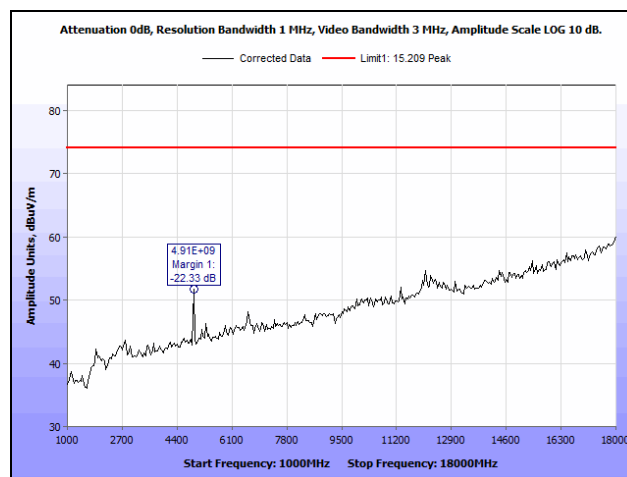
Plot 12. Radiated Spurious Emissions, Low Channel, 1 GHz – 18 GHz, Peak



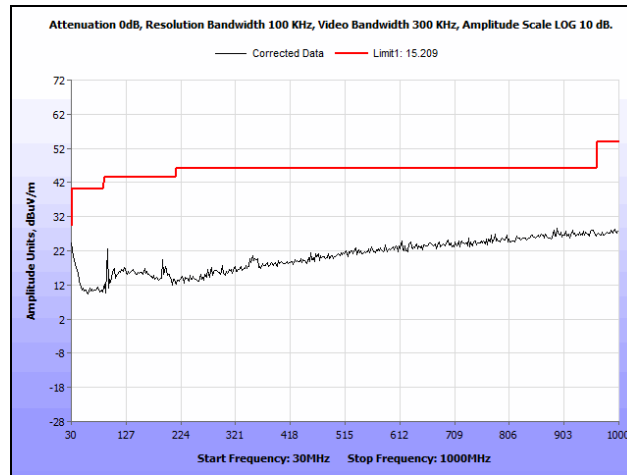
Plot 13. Radiated Spurious Emissions, Mid Channel, 30 MHz – 1 GHz



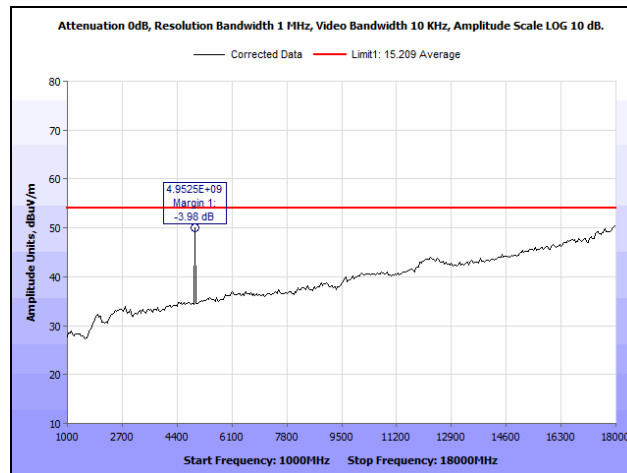
Plot 14. Radiated Spurious Emissions, Mid Channel, 1 GHz – 18 GHz, Average



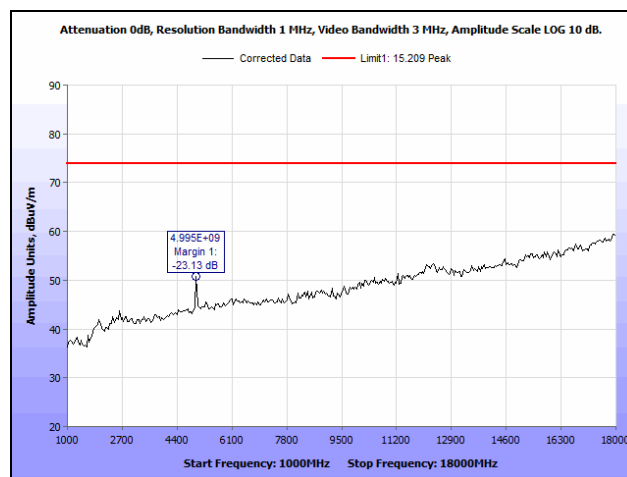
Plot 15. Radiated Spurious Emissions, Mid Channel, 1 GHz – 18 GHz, Peak



Plot 16. Radiated Spurious Emissions, High Channel, 30 MHz – 1 GHz



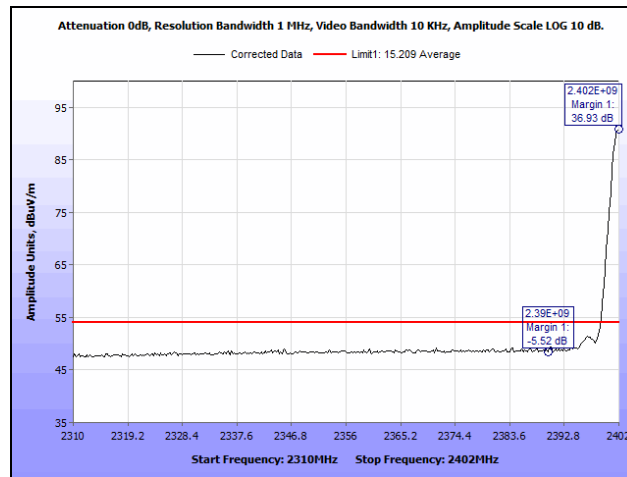
Plot 17. Radiated Spurious Emissions, High Channel, 1 GHz – 18 GHz, Average



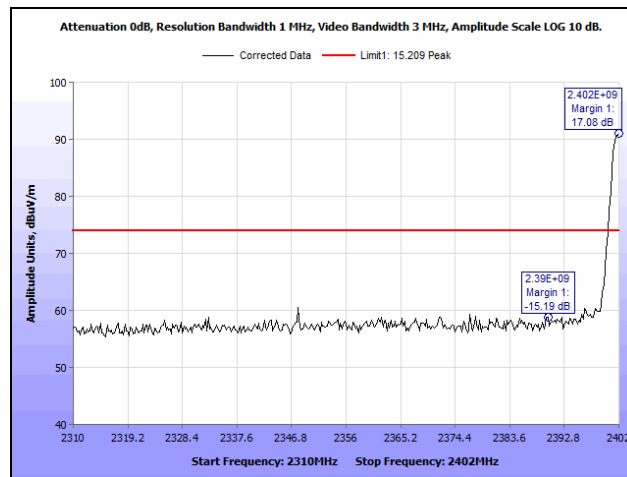
Plot 18. Radiated Spurious Emissions, High Channel, 1 GHz – 18 GHz, Peak

Radiated Band Edge Measurements

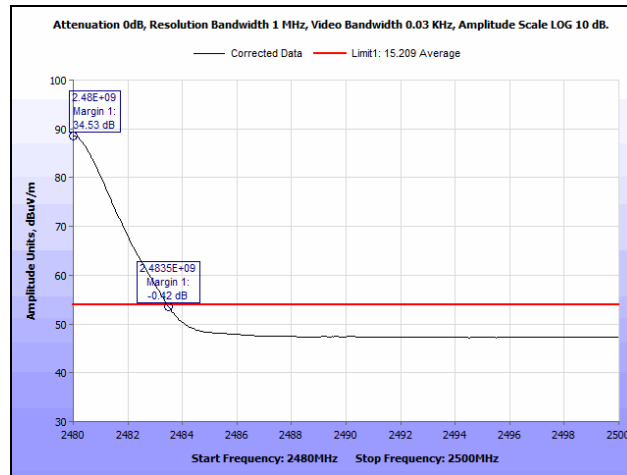
Test Procedures: The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line.



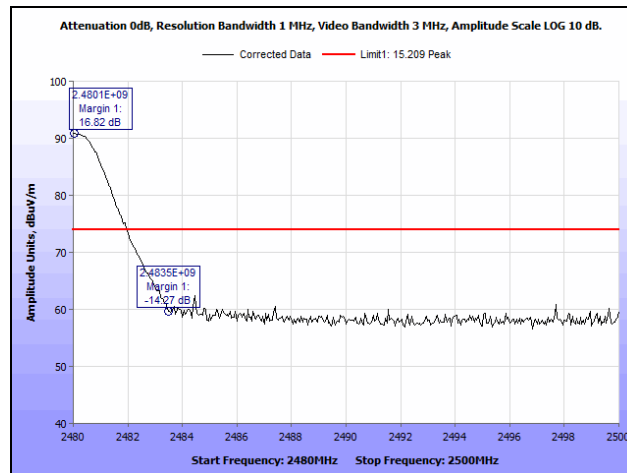
Plot 19. Radiated Restricted Band Edge, Low Channel, Average



Plot 20. Radiated Restricted Band Edge, Low Channel, Peak



Plot 21. Radiated Restricted Band Edge, High Channel, Average



Plot 22. Radiated Restricted Band Edge, High Channel, Peak

Radiated Spurious Emissions Test Setup



Photograph 2. Radiated Spurious Emissions, 30 MHz – 1 GHz Test Setup



Photograph 3. Radiated Spurious Emissions, 1 GHz – 18 GHz Test Setup

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.

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

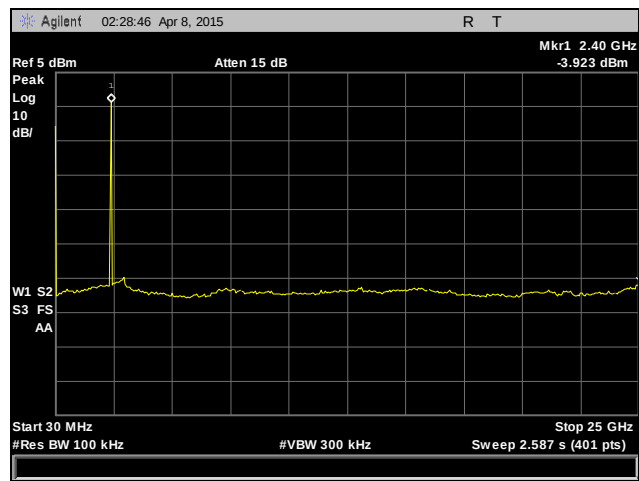
Test Engineer(s): Benjamin Taylor

Test Date(s): 04/19/15

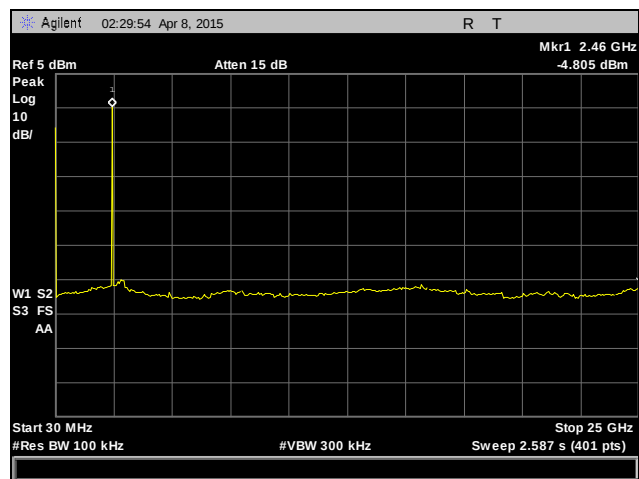


Figure 3. Block Diagram, Conducted Spurious Emissions Test Setup

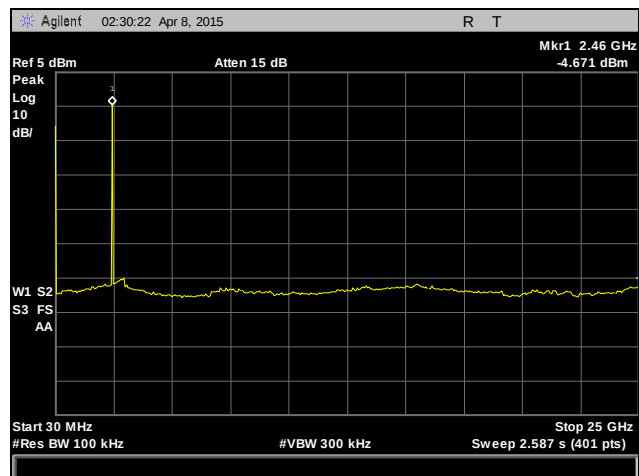
Conducted Spurious Emissions Test Results



Plot 23. Conducted Spurious Emissions, Low Channel, 30 MHz – 25 GHz

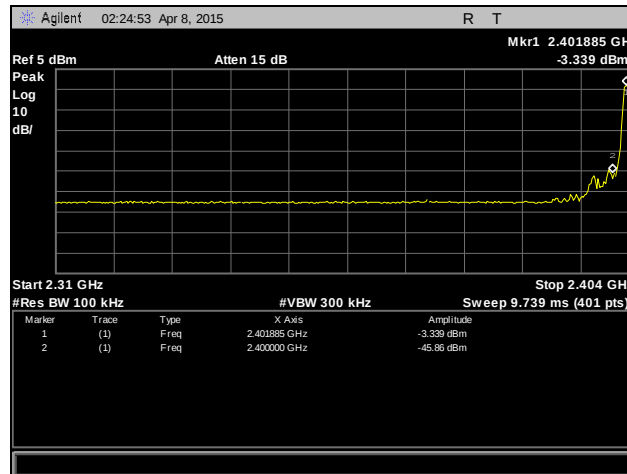


Plot 24. Conducted Spurious Emissions, Mid Channel, 30 MHz – 25 GHz

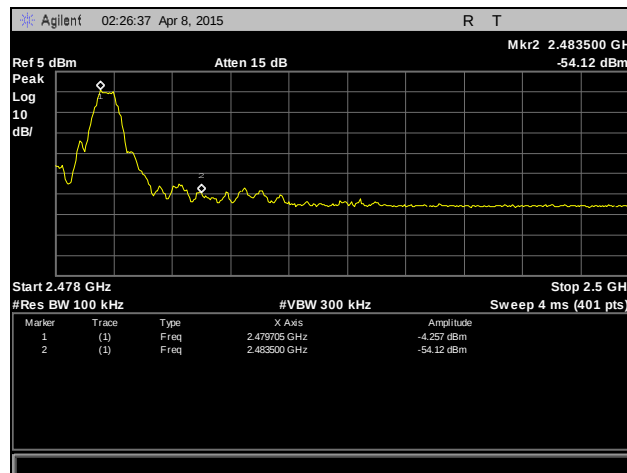


Plot 25. Conducted Spurious Emissions, High Channel, 30 MHz – 25 GHz

Conducted Band Edge Test Results



Plot 26. Conducted Band Edge, Low Channel



Plot 27. Conducted Band Edge, High Channel

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(e) Peak Power Spectral Density

Test Requirements: §15.247(e): For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

Test Procedure: The transmitter was connected directly to a Spectrum Analyzer through an attenuator. The power level was set to the maximum level throughout each of the 100 sweeps of power averaging. The RBW was set to 3 kHz and a VBW set to 9 kHz or greater. The spectrum analyzer was set to an auto sweep time and a peak detector was used. Measurements were carried out at the low, mid and high channels.

Test Results: The EUT was compliant with the peak power spectral density limits of § 15.247 (e).

The peak power spectral density was determined from plots on the following page(s).

Test Engineer: Benjamin Taylor

Test Date: 04/19/15

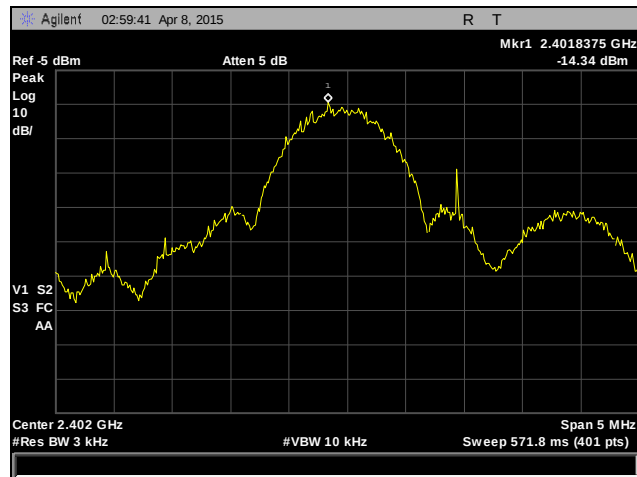


Figure 4. Block Diagram, Peak Power Spectral Density Test Setup

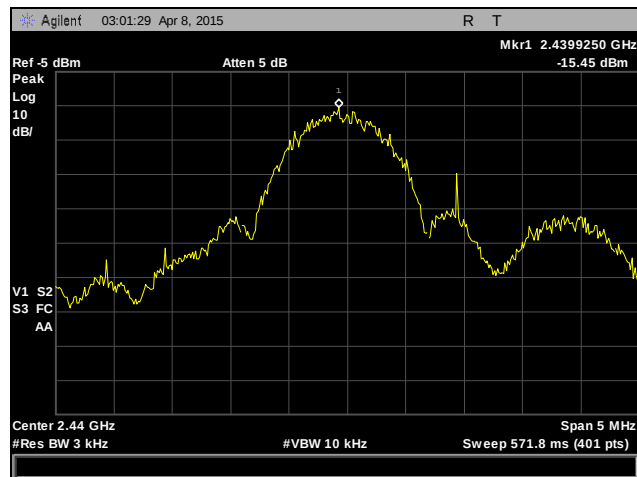
Peak Power Spectral Density				
Carrier Channel	Frequency (MHz)	Measured PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-14.34	8	-22.34
Mid	2440	-15.45	8	-23.45
High	2480	-16.23	8	-34.23

Table 11. Peak Power Spectral Density, Test Results

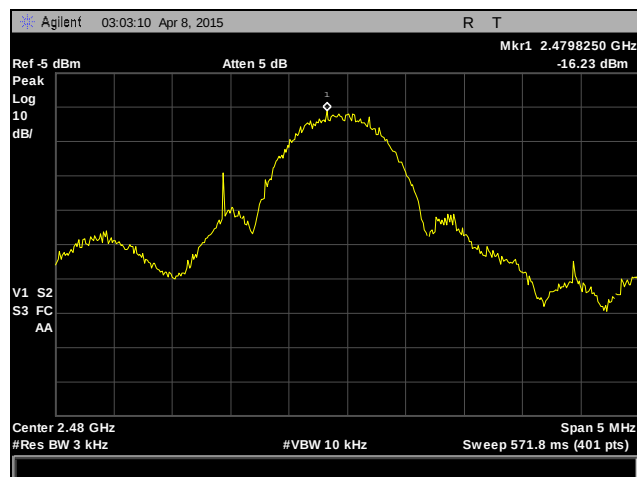
Peak Power Spectral Density



Plot 28. Peak Power Spectral Density, Low Channel



Plot 29. Peak Power Spectral Density, Mid Channel



Plot 30. Peak Power Spectral Density, High Channel

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(i) Maximum Permissible 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.

FCC KDB 447498:

- 1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR and ≤ 7.5 for 10-g extremity SAR,²⁵ where

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation²⁶
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum *test separation distance* is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum *test separation distance* is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

$$1\text{mW}/5\text{mm} \sqrt{2.480}=0.3$$

Test Results: The EUT is exempt from SAR testing, as per the calculation based on FCC KDB 447498. Power and frequency were rounded to calculate based on the worst-case scenario.

IV. Test Equipment

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2005.

MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4300A	SEMI-ANECHOIC CHAMBER # 1 (FCC)	EMC TEST SYSTEMS	NONE	07/24/2012	07/24/2015
1T4751	ANTENNA - BILOG	SUNOL SCIENCES	JB6	07/29/2014	01/29/2016
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	10/29/2014	10/29/2016
1T4771	PSA SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4446A	11/25/2014	05/25/2016
1T4483	ANTENNA; HORN	ETS-LINDGREN	3117	02/28/2014	08/28/2015
1T4442	PRE-AMPLIFIER, MICROWAVE	MITEQ	AFS42-01001800-30-10P	SEE NOTE	
1T4859	DIGITAL BAROMETER, HYGROMETER, THERMOMETER	CONTROL COMPANY	15-078-198, FB70423, 245CD	12/19/2013	12/19/2015

Table 12. Test Equipment List

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



AKRAPOVIC d.d.

Akrapovic Sound Kit/Sound Receiver (P-HF841)

Electromagnetic Compatibility
Certification & User's Manual Information
CFR Title 47, Part 15.247; RSS-210, Issue 8, Dec. 2010

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

1. 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.

ICES-003 Procedural & Labeling Requirements

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

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

Procedural Requirements:

According to Industry Canada's Interference Causing Equipment Standard for Digital Apparatus ICES-003 Issue 5 August 2012:

- Section 6.1: A record of the measurements and results, showing the date that the measurements were completed, shall be retained by the manufacturer or importer for a period of at least five years from the date shown in the record and made available for examination on the request of the Minister.
- Section 6.2: A written notice indicating compliance must accompany each unit of digital apparatus to the end user. The notice shall be in the form of a label that is affixed to the apparatus. Where because of insufficient space or other constraints it is not feasible to affix a label to the apparatus, the notice may be in the form of a statement in the users' manual.

Labeling Requirements:

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

This Class [²] digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe [¹] est conforme à la norme NMB-003 du Canada.

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



AKRAPOVIC d.d.

Akrapovic Sound Kit/Sound Receiver (P-HF841)

Electromagnetic Compatibility

End of Report

CFR Title 47, Part 15.247; RSS-210, Issue 8, Dec. 2010

End of Report