



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

914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230 • 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, CALIFORNIA 95054 • PHONE (408) 748-3585 • FAX (510) 489-6372

13301 MCCALLEN PASS • AUSTIN, TEXAS 78753 • PHONE (512) 287-2500 • FAX (512) 287-2513

May 21, 2014

QinetiQ North America  
350 Second Ave.  
Waltham, MA 02451

Dear Chuck Deloid,

Enclosed is the EMC Wireless test report for compliance testing of the QinetiQ North America, ASSY, Setup Tool as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 15, Subpart B, ICES-003, Issue 5 August 2012 for a Class A Digital Device and FCC Part 15 Subpart C, RSS-210, Issue 8, December 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: (\QinetiQ North America\EMC38758B-FCC249 Rev. 4)

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

**QinetiQ North America  
ASSY, Setup Tool**

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

**MET Report: EMC38758B-FCC249 Rev. 4**

May 21, 2014

**Prepared For:**

**QinetiQ North America  
350 Second Ave.  
Waltham, MA 02451**

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

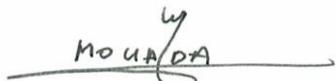
## Electromagnetic Compatibility Criteria Test Report

for the

**QinetiQ North America  
ASSY, Setup Tool**

### Tested Under

the FCC Certification Rules  
contained in  
Title 47 of the CFR, Parts 15 Subpart B & ICES-003  
for Class A Digital Devices  
&  
15.249 Subpart C & RSS-210, Issue 8, December 2010  
for Intentional Radiators



Djed Mouada, 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, 15.249 and Industry Canada standards ICES-003, Issue 5 August 2012, RSS-210, Issue 8, December 2010 under normal use and maintenance.



Asad Bajwa, Director  
Electromagnetic Compatibility Lab



## Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	January 3, 2014	Initial Issue.
1	February 25, 2014	Revised to reflect engineer corrections.
2	April 9, 2014	Revised to reflect engineer corrections.
3	April 17, 2014	Revised to reflect engineer corrections.
4	May 21, 2014	Revised to reflect engineer corrections.

## Table of Contents

<b>I.</b>	<b>Executive Summary .....</b>	<b>1</b>
	A. Purpose of Test .....	2
	B. Executive Summary.....	2
<b>II.</b>	<b>Equipment Configuration .....</b>	<b>3</b>
	A. Overview .....	4
	B. References .....	4
	C. Test Site .....	5
	D. Description of Test Sample.....	5
	E. Equipment Configuration .....	6
	F. Support Equipment .....	6
	G. Mode of Operation.....	6
	H. Monitoring Method.....	6
	I. Modifications .....	6
	a) Modifications to EUT .....	6
	b) Modifications to Test Standard.....	6
	J. Disposition of EUT.....	6
<b>III.</b>	<b>Electromagnetic Compatibility Criteria for Unintentional Radiators .....</b>	<b>7</b>
	§ 15.107(a) Conducted Emissions Limits.....	8
	§ 15.109(a) Radiated Emission Limits .....	9
<b>IV.</b>	<b>Electromagnetic Compatibility Criteria for Intentional Radiators.....</b>	<b>12</b>
	§ 15.203 Antenna Requirement .....	13
	§ 15.249(a) Radiated Fundament and Harmonics .....	14
	20 dB and 99% Occupied Bandwidth.....	18
	§ 15.249(d) Spurious Emissions Requirements .....	23
<b>V.</b>	<b>Test Equipment .....</b>	<b>32</b>
<b>VI.</b>	<b>Certification &amp; User's Manual Information .....</b>	<b>34</b>
	A. Certification Information .....	35
	B. Label and User's Manual Information.....	39
<b>VII.</b>	<b>ICES-003 Procedural &amp; Labeling Requirements.....</b>	<b>41</b>

## List of Tables

Table 1. Executive Summary of EMC Part 15.249 Compliance Testing .....	2
Table 2. EUT Specifications .....	4
Table 3. References .....	4
Table 4. Equipment Configuration .....	6
Table 5. Support Equipment .....	6
Table 6. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Section 15.107(a) (b) .....	8
Table 7. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b) .....	9
Table 8. Radiated Emissions Limits, Test Results, 30 MHz – 1 GHz .....	10
Table 9. Field Strength, Test Results .....	14
Table 10. Occupied Bandwidth, Test Results .....	18

## List of Photographs

Photograph 1. Radiated Emissions, Test Setup .....	11
Photograph 2. Radiated Field Strength, Test Setup .....	17
Photograph 3. Radiated Spurious Emissions, Test Setup, 30 MHz – 1 GHz .....	31
Photograph 4. Radiated Spurious Emissions, Test Setup, 1 GHz – 18 GHz .....	31

## List of Plots

Plot 1. Radiated Emissions, Pre-Scan, 30 MHz – 1 GHz .....	10
Plot 2. Radiated Field Strength of Fundamental, 2465 MHz .....	15
Plot 3. Radiated Field Strength of Fundamental, 2471 MHz .....	15
Plot 4. Radiated Field Strength of Fundamental, 2473 MHz .....	16
Plot 5. Radiated Field Strength of Fundamental, 2479 MHz .....	16
Plot 6. 20 dB Occupied Bandwidth, 2465 MHz .....	19
Plot 7. 20 dB Occupied Bandwidth, 2471 MHz .....	19
Plot 8. 20 dB Occupied Bandwidth, 2473 MHz .....	20
Plot 9. 20 dB Occupied Bandwidth, 2479 MHz .....	20
Plot 10. 99% Occupied Bandwidth, 2465 MHz .....	21
Plot 11. 99% Occupied Bandwidth, 2471 MHz .....	21
Plot 12. 99% Occupied Bandwidth, 2473 MHz .....	22
Plot 13. 99% Occupied Bandwidth, 2479 MHz .....	22
Plot 14. Radiated Spurious Emissions, 2465 MHz, 30 MHz – 1 GHz .....	24
Plot 15. Radiated Spurious Emissions, 2465 MHz, Peak under Average, 1 GHz – 18 GHz .....	24
Plot 16. Radiated Spurious Emissions, 2471 MHz, 30 MHz – 1 GHz .....	25
Plot 17. Radiated Spurious Emissions, 2471 MHz, Peak under Average, 1 GHz – 18 GHz .....	25
Plot 18. Radiated Spurious Emissions, 2473 MHz, 30 MHz – 1 GHz .....	26
Plot 19. Radiated Spurious Emissions, 2473 MHz, Peak under Average, 1 GHz – 18 GHz .....	26
Plot 20. Radiated Spurious Emissions, 2479 MHz, 30 MHz – 1 GHz .....	27
Plot 21. Radiated Spurious Emissions, 2479 MHz, Peak under Average, 1 GHz – 18 GHz .....	27
Plot 22. Restricted Band, 2465 MHz, Peak under Average .....	28
Plot 23. Restricted Band, 2471 MHz, Peak under Average .....	28
Plot 24. Restricted Band, 2473 MHz, Peak .....	29
Plot 25. Restricted Band, 2473 MHz, Average .....	29
Plot 26. Restricted Band, 2479 MHz, Peak .....	30
Plot 27. Restricted Band, 2479 MHz, Average .....	30

## List of Terms and Abbreviations

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

## I. Executive Summary

## A. Purpose of Test

An EMC evaluation was performed to determine compliance of the QinetiQ North America ASSY, Setup Tool, with the requirements of Part 15, §15.249. 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 ASSY, Setup Tool. QinetiQ North America should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the ASSY, Setup Tool, 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, §15.249, in accordance with QinetiQ North America, purchase order number T9G74-0116. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference	Canada Reference	Description	Results
15.107	ICES-003	AC Power Line Conducted Emissions	Not Applicable
15.109	ICES-003	Radiated Emissions	Compliant
§15.203	RSS GEN §7.1.2	Antenna Requirement	Compliant
§15.207	RSS GEN §7.2.4	AC Power Line Conducted Emissions	Not Applicable
§15.249 (a)	RSS-210 A2.9	Field Strength of Fundamental	Compliant
§15.249(a)(d), §15.209	RSS-Gen §7.2.5 and RSS-210 A2.0	Harmonics and Spurious Emissions	Compliant
§15.215(c)	RSS GEN §4.6.1	20 dB Bandwidth	Compliant

**Table 1. Executive Summary of EMC Part 15.249 Compliance Testing**

## II. Equipment Configuration

## A. Overview

MET Laboratories, Inc. was contracted by QinetiQ North America to perform testing on the ASSY, Setup Tool, under QinetiQ North America's purchase order number T9G74-0116.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the QinetiQ North America, ASSY, Setup Tool.

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

<b>Model(s) Tested:</b>	ASSY, Setup Tool
<b>EUT Specifications:</b>	Primary Power to Module: from medium voltage power lines
	FCC ID: YWL LWST140001
	IC: 10793A-LWST140001
	Type of Modulations:
	2-FSK
	Equipment Code:
	DXX
	Emission Designator:
	F7D
	Highest Fundamental Field Strength:
	88.39 dBuV/m
	EUT Frequency Ranges:
	2465 – 2479 MHz
<b>Analysis:</b>	The results obtained relate only to the item(s) tested.
<b>Environmental Test Conditions:</b>	Temperature (15-35° C)
	Relative Humidity (30-60%)
	Barometric Pressure (860-1060 mbar)
<b>Evaluated by:</b>	Djed Mouada
<b>Report Date(s):</b>	May 21, 2014

**Table 2. EUT Specifications**

## B. References

<b>CFR 47, Part 15, Subpart C</b>	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: General Rules and Regulations, Allocation, Assignment, and Use of Radio Frequencies
<b>CFR 47, Part 15, Subpart B</b>	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
<b>RSS-210, Issue 8, December 2010</b>	Low-power License-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment
<b>ICES-003, Issue 5 August 2012</b>	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
<b>ANSI C63.4:2003</b>	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
<b>ISO/IEC 17025:2005</b>	General Requirements for the Competence of Testing and Calibration Laboratories
<b>ANSI C63.10-2009</b>	American National Standard for Testing Unlicensed Wireless Devices

**Table 3. References**

### C. Test Site

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

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

### D. Description of Test Sample

The QinetiQ North America ASSY, Setup Tool, Equipment Under Test (EUT), is a device that takes readings of a medium voltage power line by placing the unit directly onto the power line. These readings are sent on to the user via a 2.4 GHz radio, and are then used to calibrate MVSS Sensors during installation.

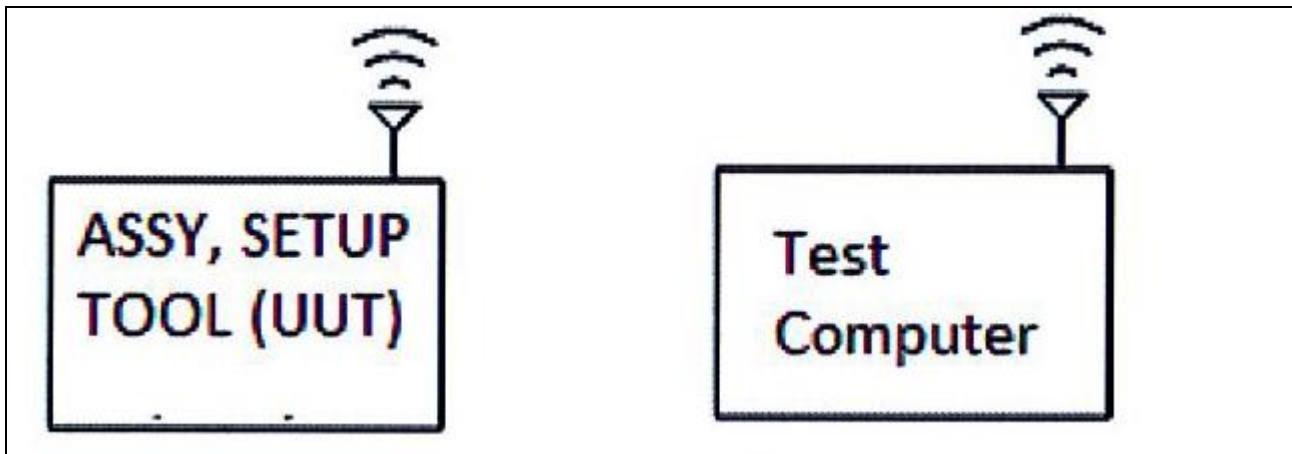


Figure 1. Block Diagram of Test Configuration

## 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	Revision
N/A	Product, ASSY, Setup Tool	PRD-1102196000	1102191127	00001	A

**Table 4. Equipment Configuration**

## F. Support Equipment

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

Name / Description	Manufacturer	Model Number	Serial Number
PC/Laptop with Windows 7 OS	N/A	N/A	N/A
Customer supplied wifi configuration program	QinetiQ	N/A	N/A
Wifi Card	Netgear	WNDA3100 v2	N/A

**Table 5. Support Equipment**

## G. Mode of Operation

As the Setup Tool uses only one radio, only one radio will need to be tested. This should be done by ensuring that each radio is capable of continuously sending and receiving “dummy” data packets representative of actual in-field data. The device should be able to send and receive this data both to the testing laptop (which will be represented by a provided test program) via the 2.4 GHz radio. This data will be sent and received at the highest rated download and upload rate based on radio configuration. In addition to this streaming data, the device will be “pinged” and data will be sent directly to that source. The provided test software should be used to simulate nominal use.

## H. Monitoring Method

The EUT will be considered operational if the testing laptop is able to establish communication, and the unit still accepts any of the commands outlined in QNA Doc# MEMO-1102190098, including changing the mode of the radio (note that the board needs to be cycled after changing the modes). A failure occurs if communication is lost or the unit is no longer able to change mode.

## 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 QinetiQ North America upon completion of testing.

### III. Electromagnetic Compatibility Criteria for Unintentional Radiators

## Electromagnetic Compatibility Criteria for Unintentional Radiators

### § 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 6. 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 6. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.”

Frequency range (MHz)	15.107(b), Class A Limits (dB $\mu$ V)		15.107(a), Class B Limits (dB $\mu$ V)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.15- 0.5	79	66	66 - 56	56 - 46
0.5 – 5.0	73	60	56	46
5.0 - 30	73	60	60	50

Note 1 — The lower limit shall apply at the transition frequencies.

**Table 6. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Section 15.107(a) (b)**

**Test Results:** The EUT was not applicable with the Class A requirement(s) of this section. The EUT does not have conducted lines.

## Radiated Emission Limits

### § 15.109 Radiated Emissions Limits

**Test Requirement(s):**

**15.109 (a)** Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the Class B limits expressed in Table 7.

**15.109 (b)** The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the Class A limits expressed in Table 7.

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

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

**Test Procedures:**

The EUT was placed on a 0.08m-high acrylic table inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.4 were used. An antenna was located 3 m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. 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.

For the purposes of demonstrating compliance, a peak plot was taken and compared to a quasi-peak limit line. No peak emissions were detected within 10 dB of the quasi-peak limit.

**Test Results:**

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

**Test Engineer(s):**

Djed Mouada

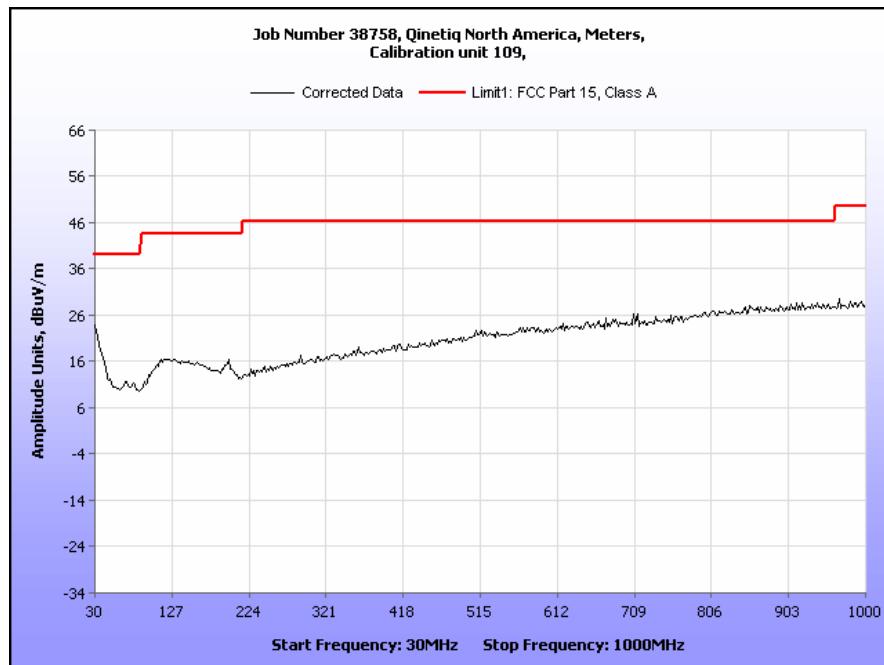
**Test Date(s):**

11/06/13

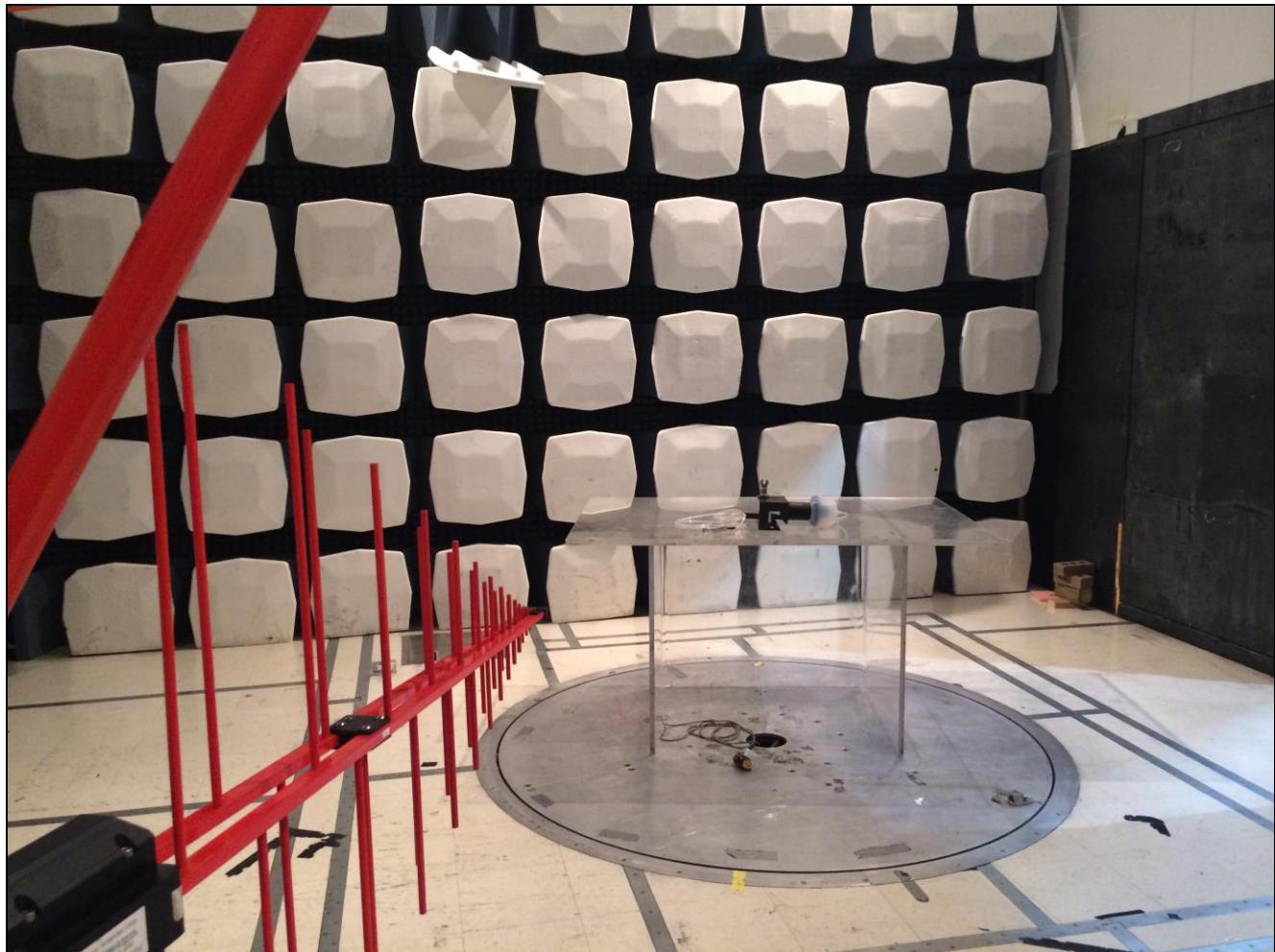
## Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dB $\mu$ V)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
125.63252	187	H	1.48	5.72	13.94	0.90	10.46	10.10	43.50	-33.40
125.63252	227	V	1.48	5.65	13.94	0.90	10.46	10.03	43.50	-33.47
172.98687	103	H	1.52	6.09	11.60	0.93	10.46	8.16	43.50	-35.34
172.98687	103	V	1.52	6.23	11.60	0.93	10.46	8.30	43.50	-35.20
456.91383	103	H	1.57	5.02	17.34	1.76	10.46	13.66	46.40	-32.74
456.91383	103	V	1.57	5.10	17.34	1.76	10.46	13.74	46.40	-32.66
566.13226	171	H	1.49	5.72	19.05	2.01	10.46	16.32	46.40	-30.08
566.13226	171	V	1.49	5.72	19.05	2.01	10.46	16.32	46.40	-30.08
771.94389	148	H	1.66	5.87	21.44	2.40	10.46	19.25	46.40	-27.15
771.94389	148	V	1.66	5.80	21.44	2.40	10.46	19.18	46.40	-27.22
912.62525	68	H	1.62	6.09	23.10	2.79	10.46	21.52	46.40	-24.88
912.62525	68	V	1.62	6.16	23.10	2.79	10.46	21.59	46.40	-24.81

Table 8. Radiated Emissions Limits, Test Results, 30 MHz – 1 GHz



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



Photograph 1. Radiated Emissions, Test Setup

## IV. Electromagnetic Compatibility Criteria for Intentional Radiators

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.203 Antenna Requirement

**Test Requirement:**

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

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

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

**Test Results:** The EUT is compliant with §15.203. This EUT is professionally installed.

**Test Engineer(s):** Djed Mouada

**Test Date(s):** 11/07/13

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.249(a) Radiated Field Strength of Fundamental

**Test Requirements:** **§ 15.249(a):** The 3 meter field strength of the fundamental emissions from intentional radiators operated within the 2400-2483.5 MHz frequency bands shall comply with the following requirement: 50 millivolts/meter (94dB $\mu$ V/m).

**Test Procedure:** Measurements were performed with the EUT rotated 360 degrees and varying the adjustable antenna mast to determine worst case orientation for maximum emissions. The antenna was placed 3m away from the EUT. The EUT was rotated about all three orthogonal axis.

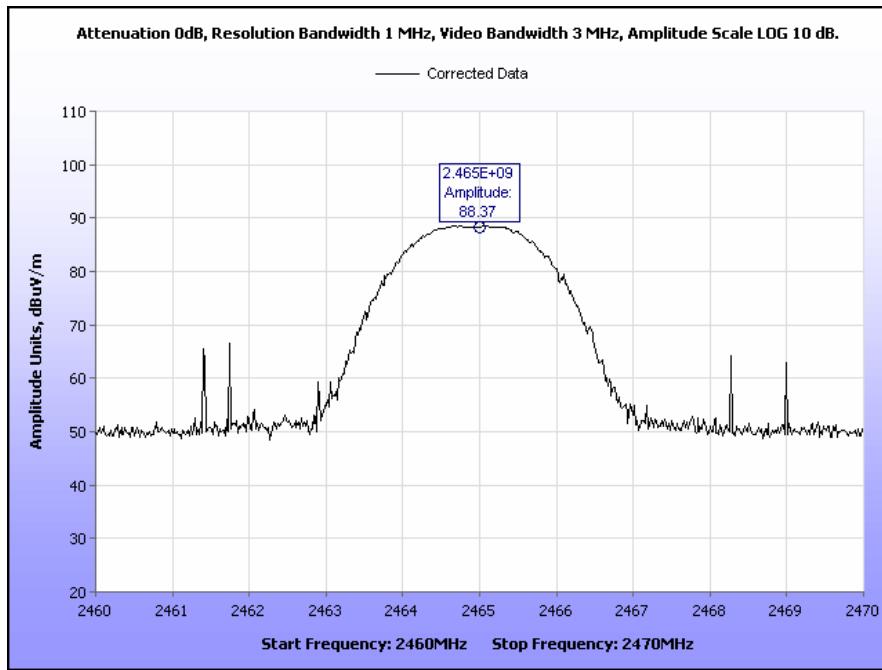
**Test Results:** The EUT is compliant with the requirements of § 15.249(a).

**Test Engineer(s):** Djed Mouada

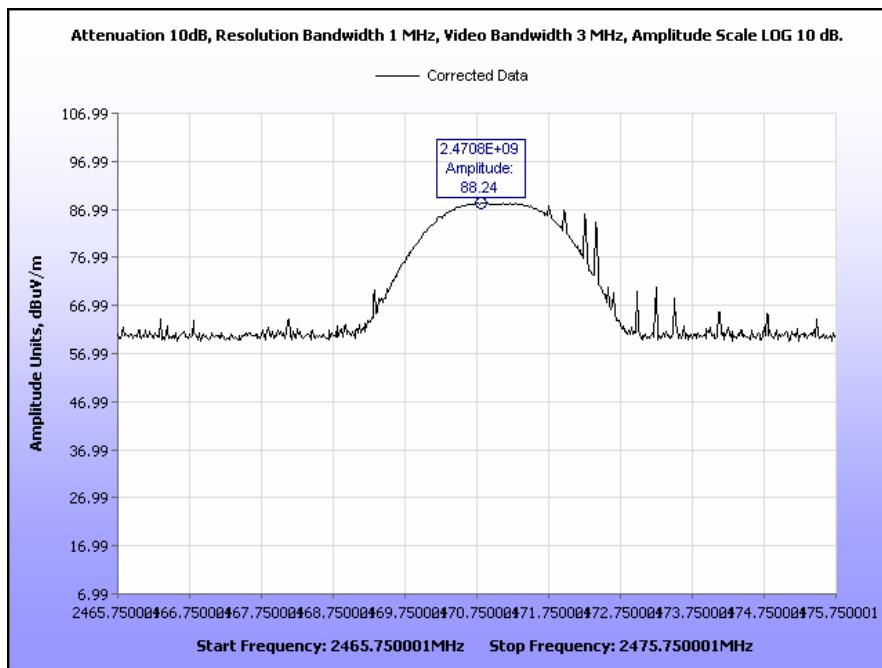
**Test Date(s):** 11/12/13 – 04/09/2014

Channel	Field Strength (dB $\mu$ V/m @ 3m)	Limit
2465 MHz	88.37	94
2471 MHz	88.24	94
2473 MHz	88.39	94
2479 MHz	88.39	94

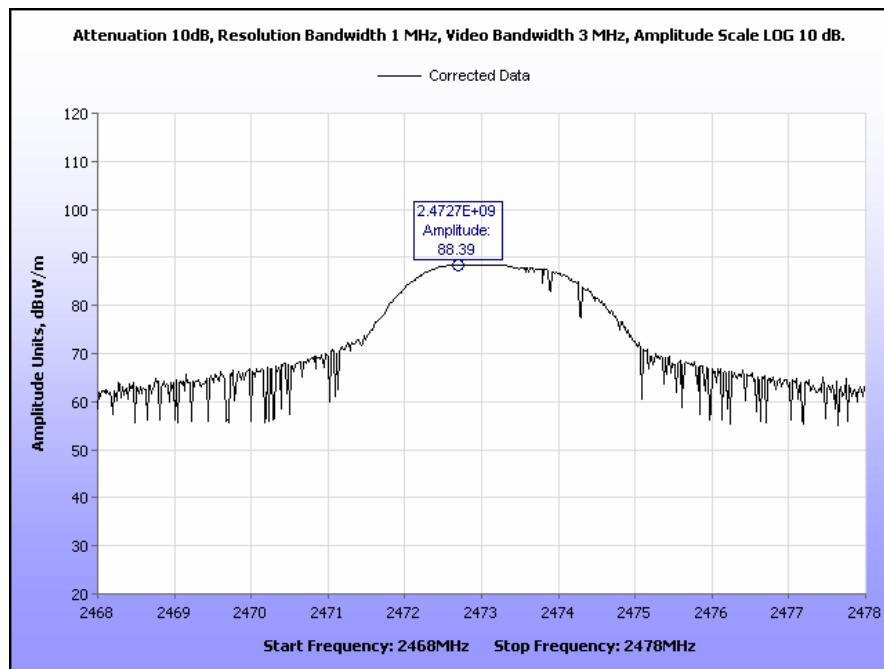
**Table 9. Field Strength, Test Results**



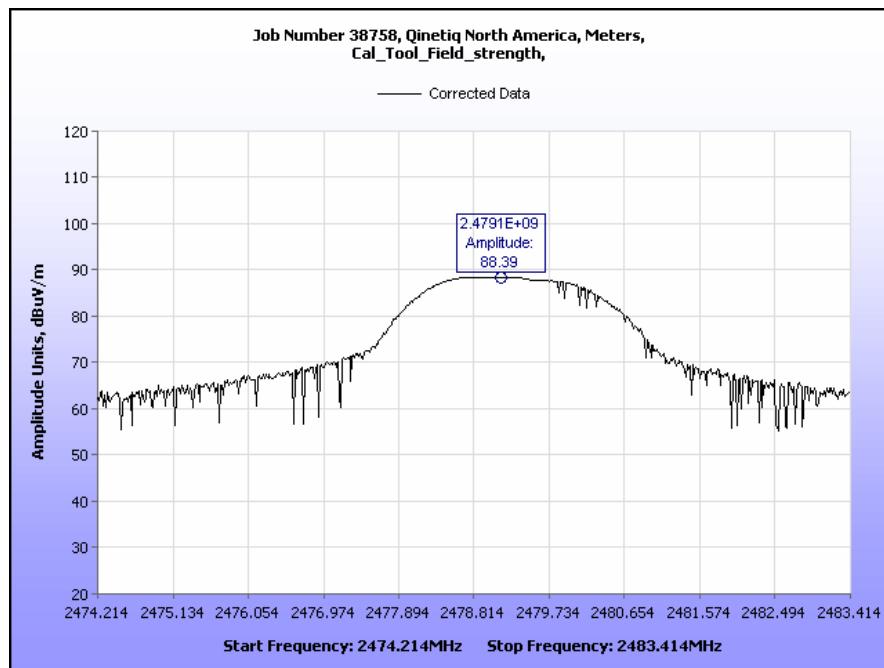
**Plot 2. Radiated Field Strength of Fundamental, 2465 MHz**



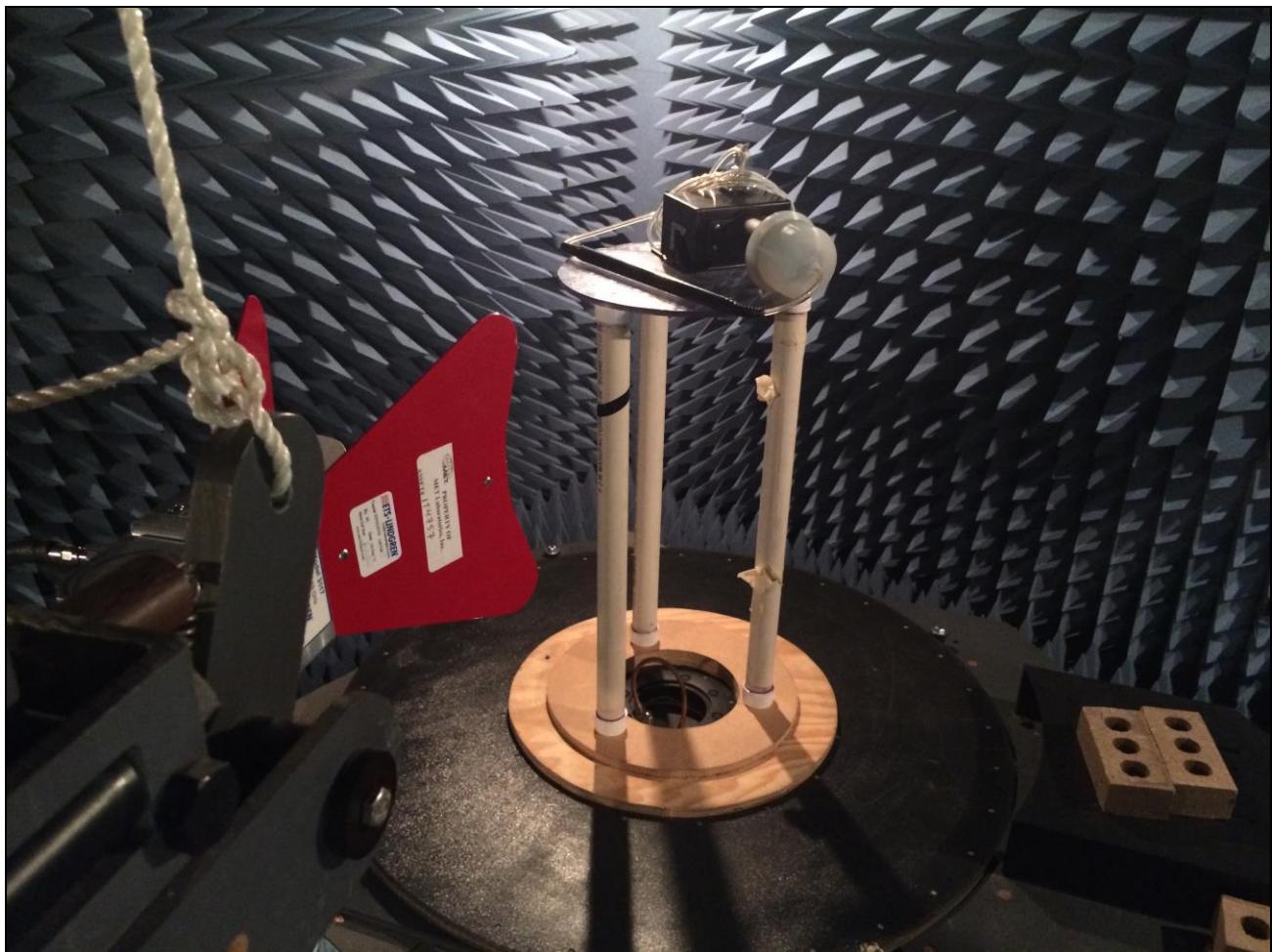
**Plot 3. Radiated Field Strength of Fundamental, 2471 MHz**



**Plot 4. Radiated Field Strength of Fundamental, 2473 MHz**



**Plot 5. Radiated Field Strength of Fundamental, 2479 MHz**



**Photograph 2. Radiated Field Strength, Test Setup**

## Electromagnetic Compatibility Criteria for Intentional Radiators

### 20 dB and 99% Occupied Bandwidth

**Test Procedure:** The EUT was transmitting into a receiving antenna connected to the spectrum analyzer, and Occupied Bandwidth measurements were taken. The 20 dB and 99% Bandwidth was measured and recorded.

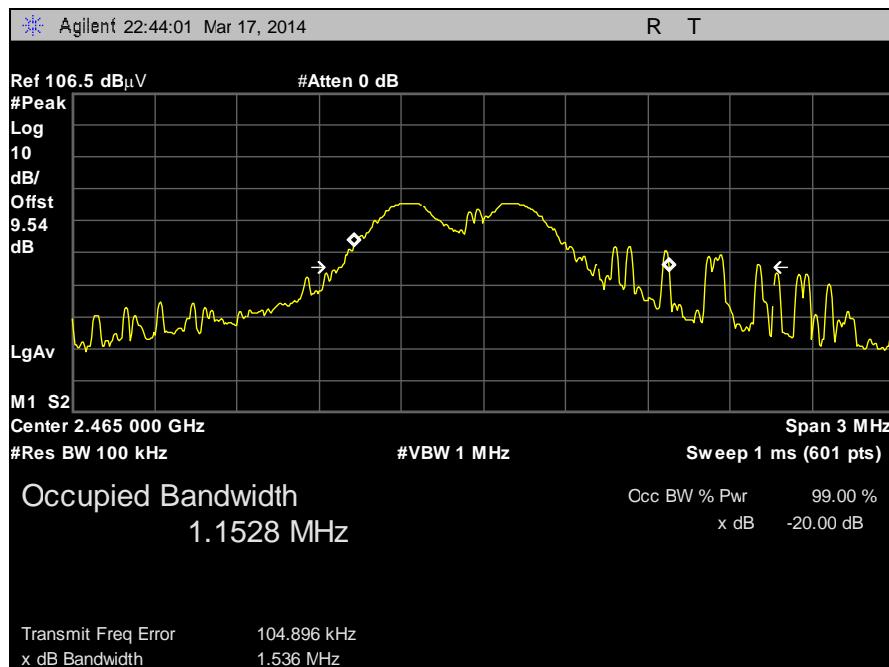
**Test Results:** See the following plots.

**Test Engineer(s):** Djed Mouada

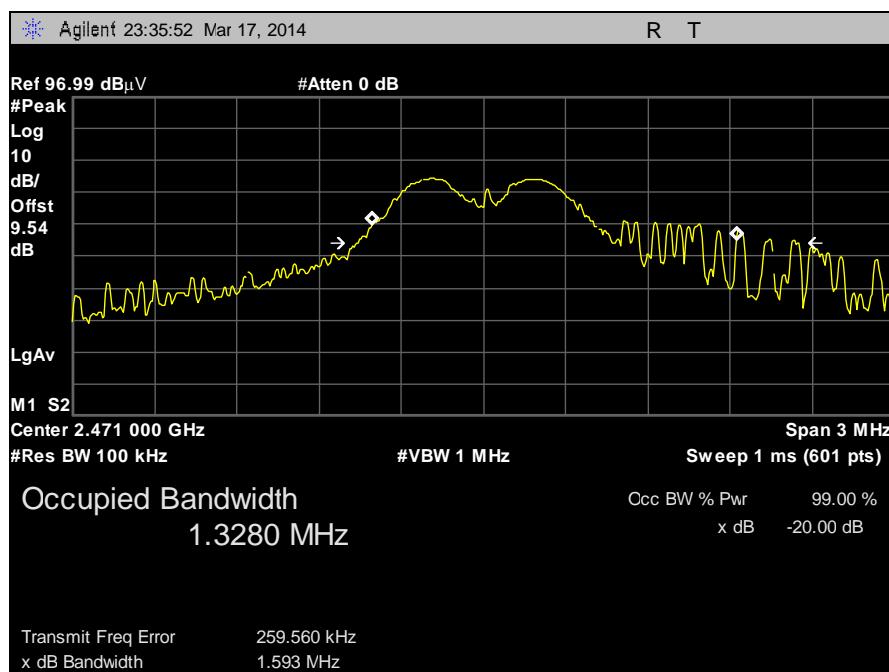
**Test Date(s):** 11/07/13 – 04/09/2014

Bandwidth	20 dB (MHz)	99% (kHz)
2465 MHz	1.536	750.0761
2471 MHz	1.593	925.8391
2473 MHz	1.483	706.7883
2479 MHz	1.508	714.7843

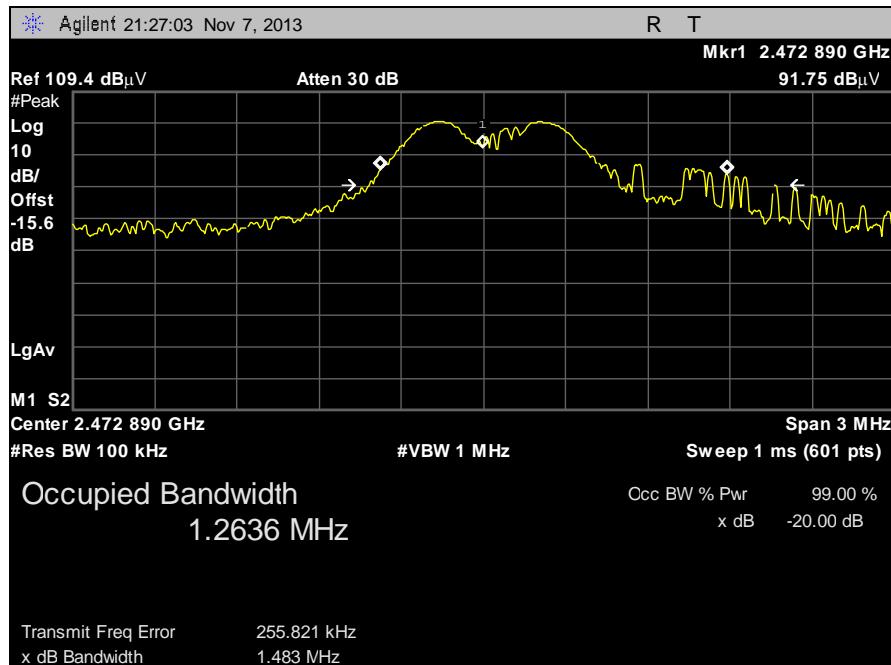
**Table 10. Occupied Bandwidth, Test Results**



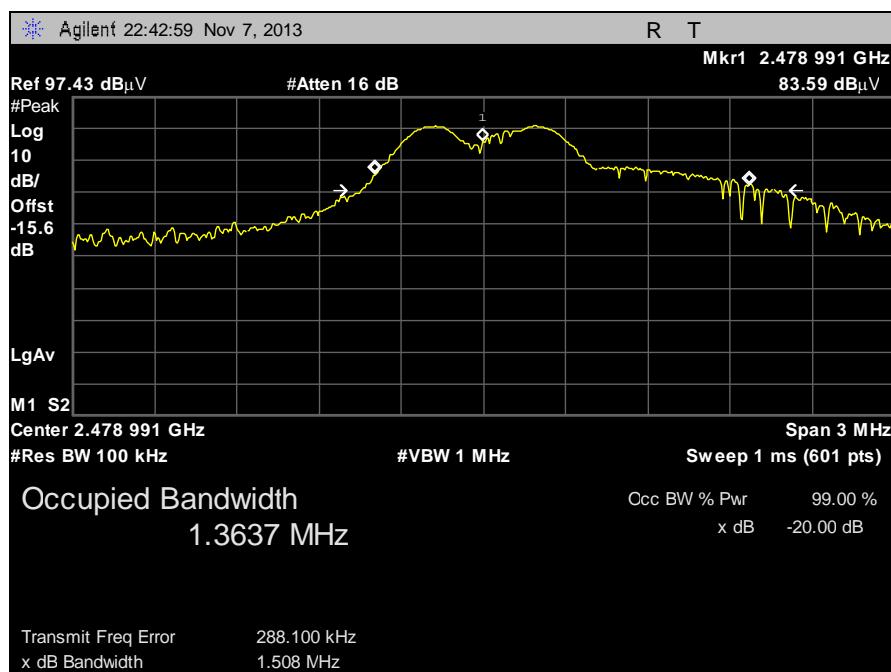
Plot 6. 20 dB Occupied Bandwidth, 2465 MHz



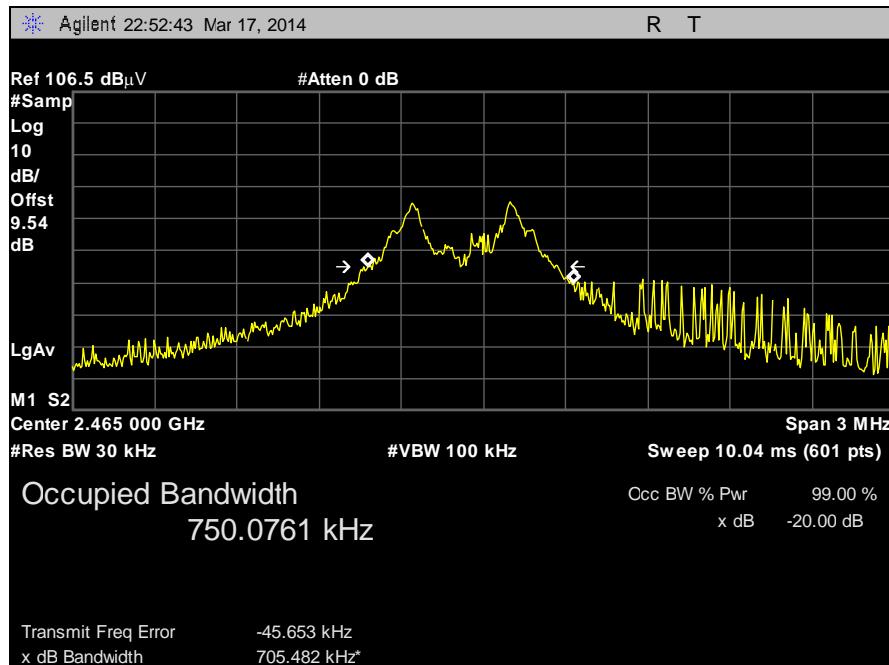
Plot 7. 20 dB Occupied Bandwidth, 2471 MHz



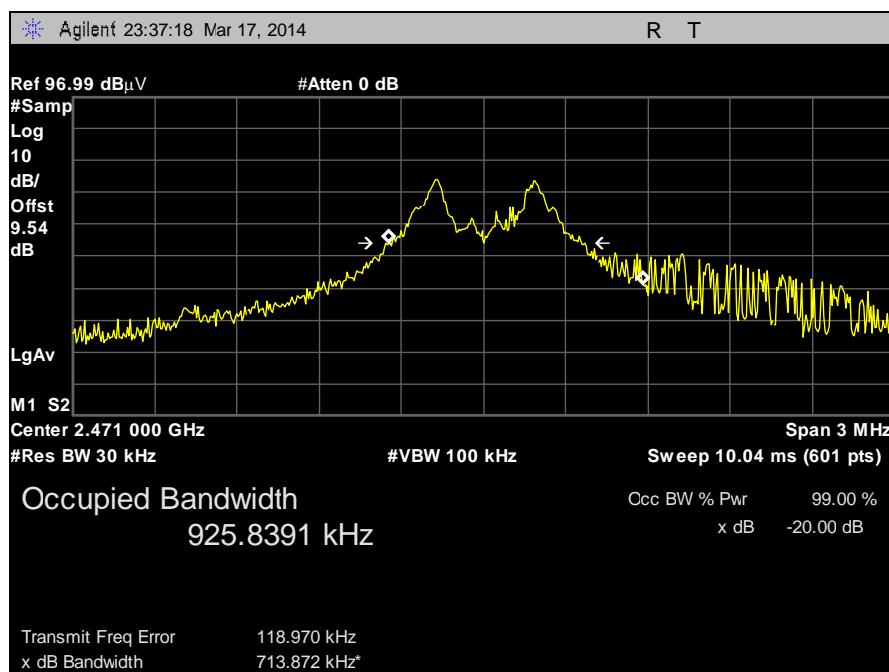
Plot 8. 20 dB Occupied Bandwidth, 2473 MHz



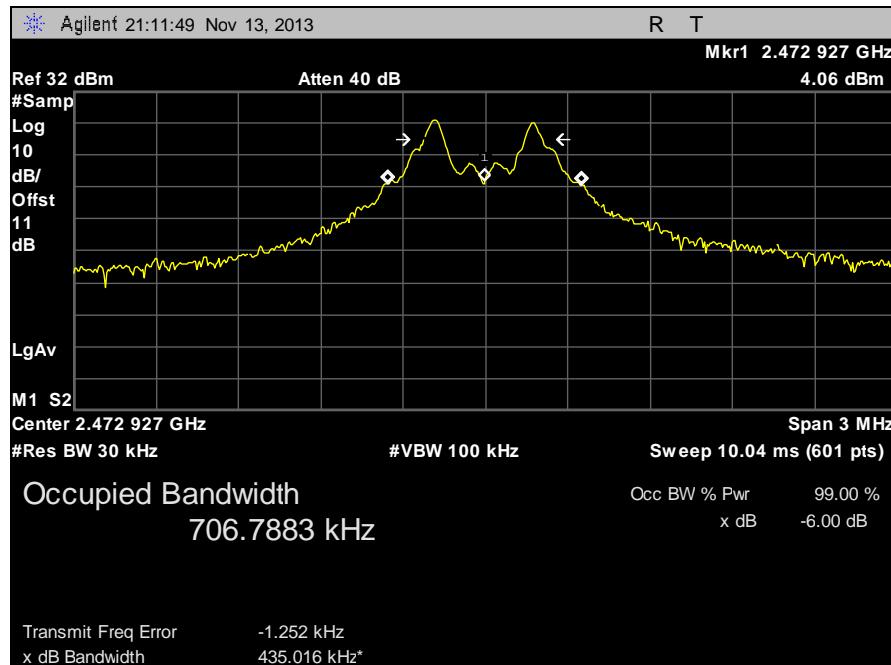
Plot 9. 20 dB Occupied Bandwidth, 2479 MHz



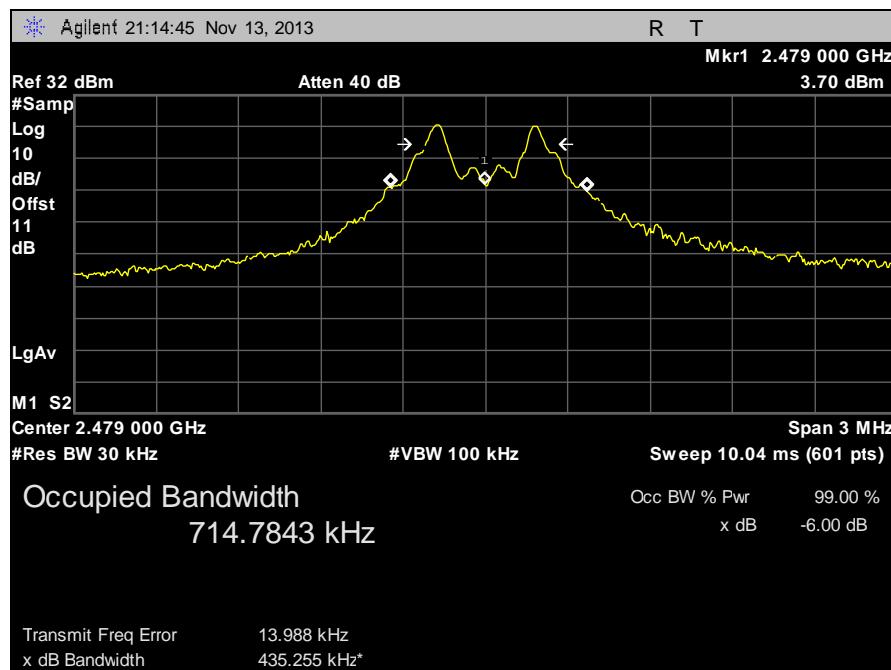
Plot 10. 99% Occupied Bandwidth, 2465 MHz



Plot 11. 99% Occupied Bandwidth, 2471 MHz



Plot 12. 99% Occupied Bandwidth, 2473 MHz



Plot 13. 99% Occupied Bandwidth, 2479 MHz

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.249(a)(d) Harmonics and Spurious Emissions Requirements

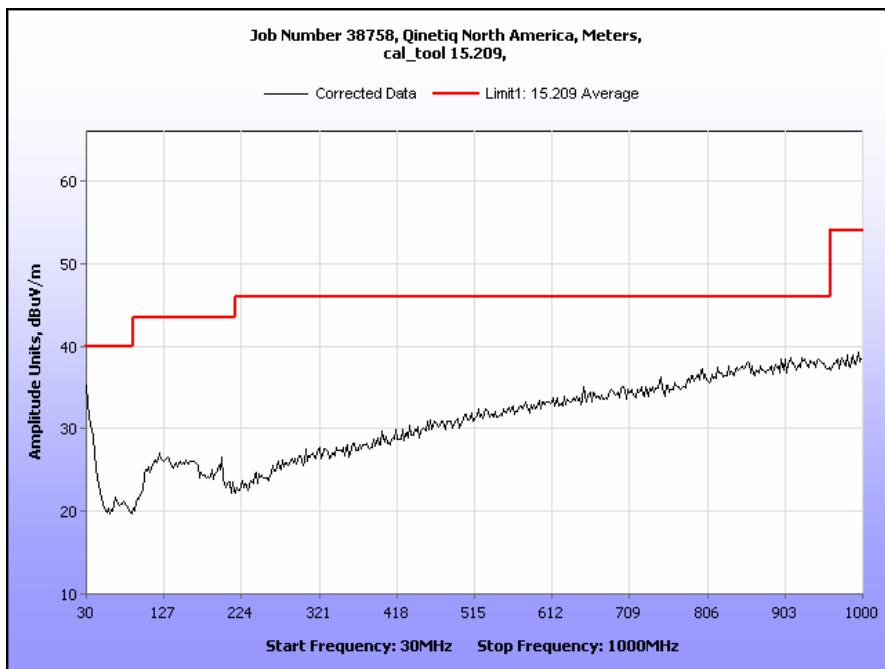
**Test Requirements:** Harmonics originating from devices that operate in the 2400-2483.5 MHz band shall meet the 500 microvolts/meter limit (i.e. 54 dBuV/m @ 3m) with an average detector. In addition, emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

**Test Procedure:** Measurements were performed with the EUT rotated 360 degrees and varying the adjustable antenna mast with 1 m to 4 m height to determine worst case orientation for maximum emissions. Emissions below 1 GHz were performed with the antenna placed 3m away from EUT. For above 1 GHz, the measuring antenna was placed 1m away.

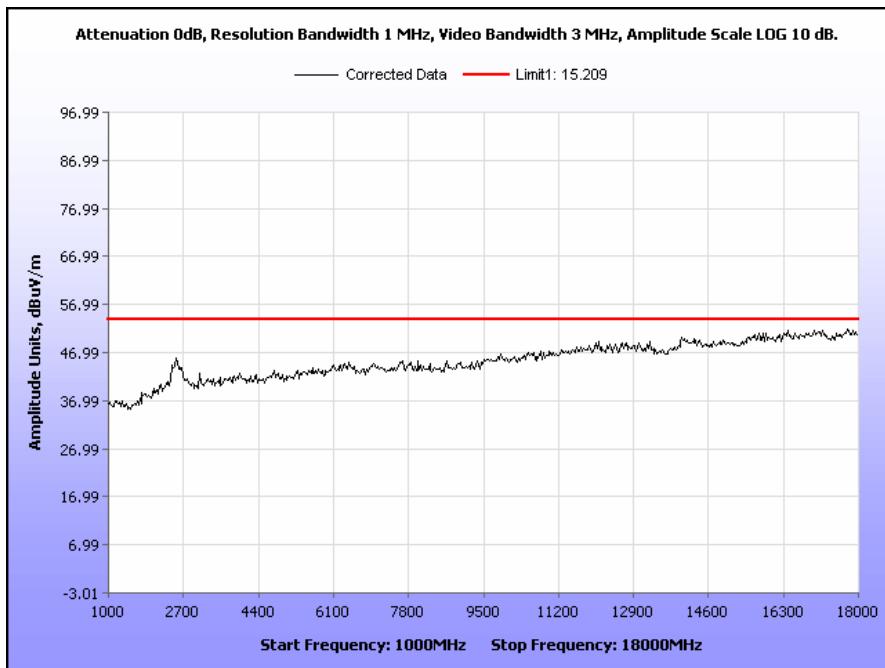
**Test Results:** The EUT is compliant with the harmonics and Spurious Emissions Requirements of §15.249(a)(d). For spurious emissions the lesser attenuation was the 15.209 limits. Only noise floor was measured above 18GHz, and a 2.4GHz notch filter was utilized in the 1-18GHz Spurious Emissions plots.

**Test Engineer(s):** Djed Mouada

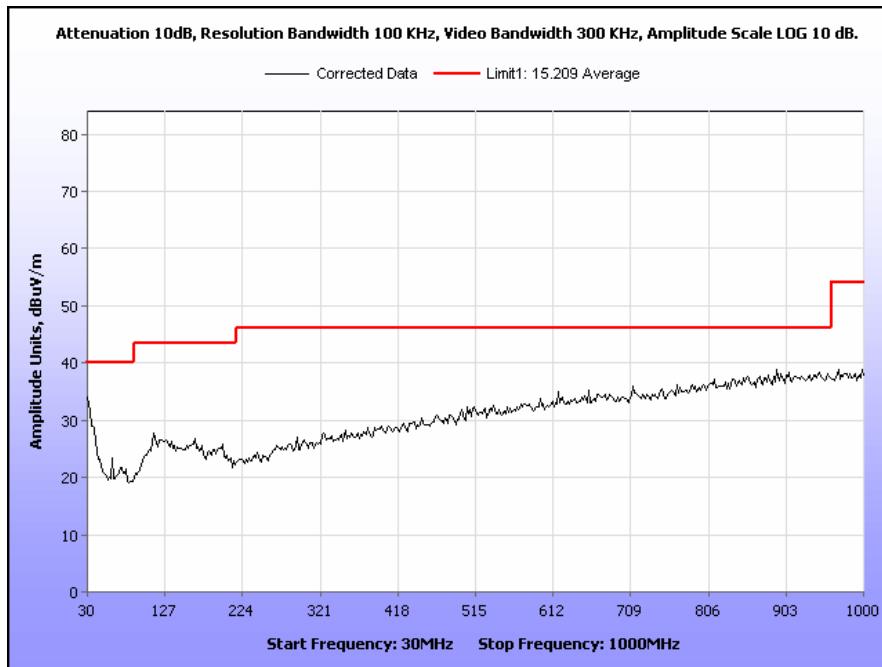
**Test Date(s):** 11/07/13 - 04/19/14



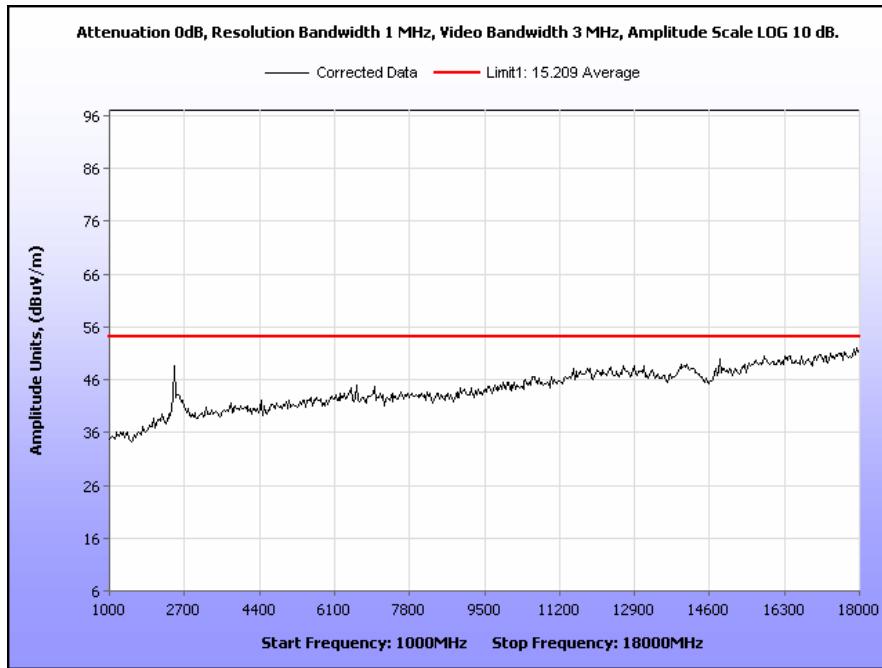
Plot 14. Radiated Spurious Emissions, 2465 MHz, 30 MHz – 1 GHz



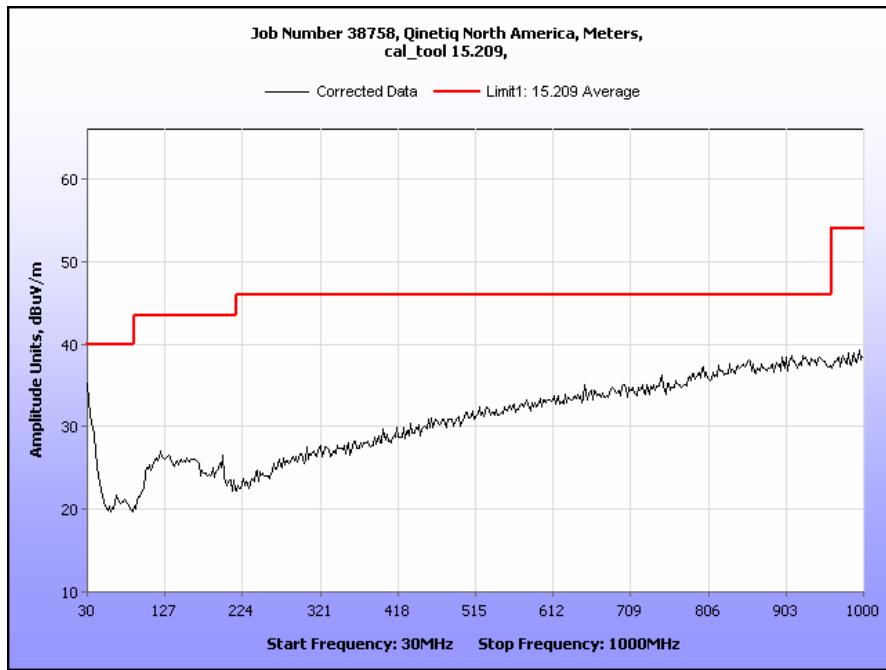
Plot 15. Radiated Spurious Emissions, 2465 MHz, Peak under Average, 1 GHz – 18 GHz



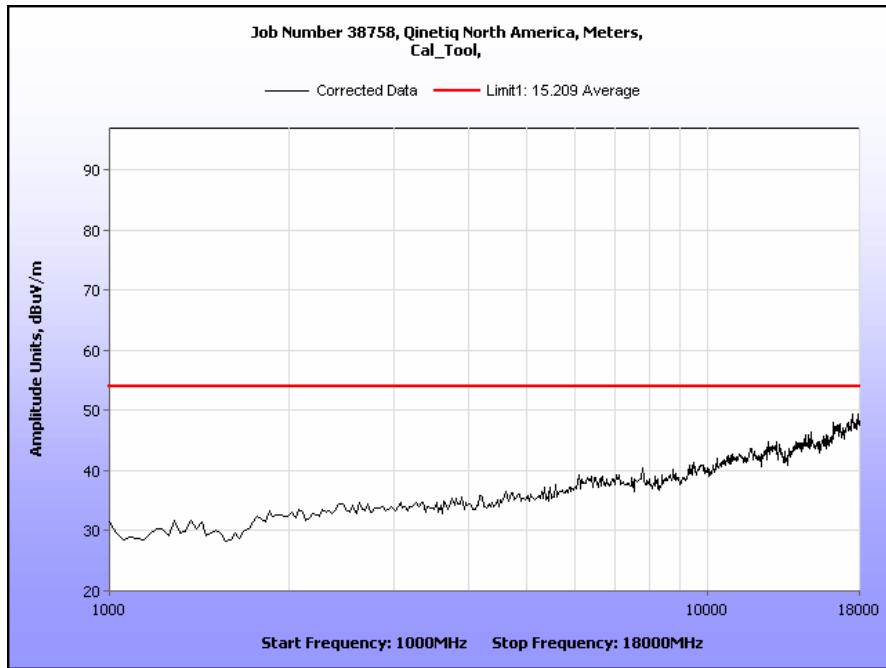
**Plot 16. Radiated Spurious Emissions, 2471 MHz, 30 MHz – 1 GHz**



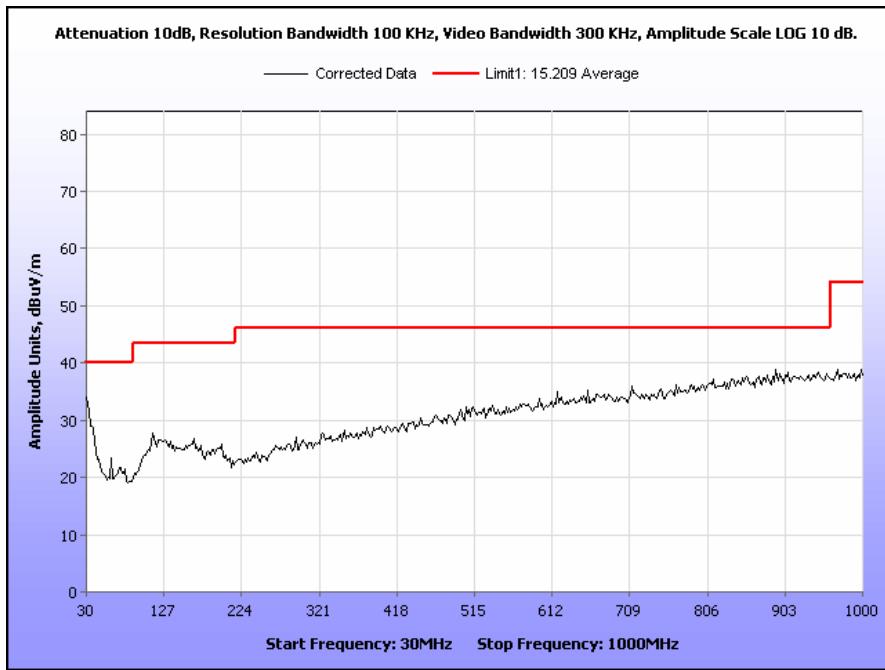
**Plot 17. Radiated Spurious Emissions, 2471 MHz, Peak under Average, 1 GHz – 18 GHz**



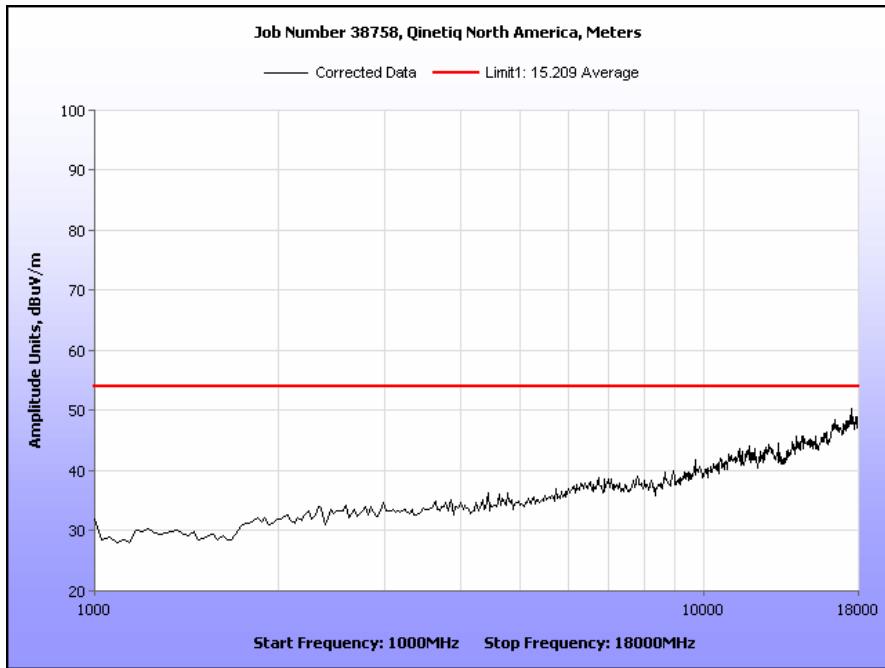
**Plot 18. Radiated Spurious Emissions, 2473 MHz, 30 MHz – 1 GHz**



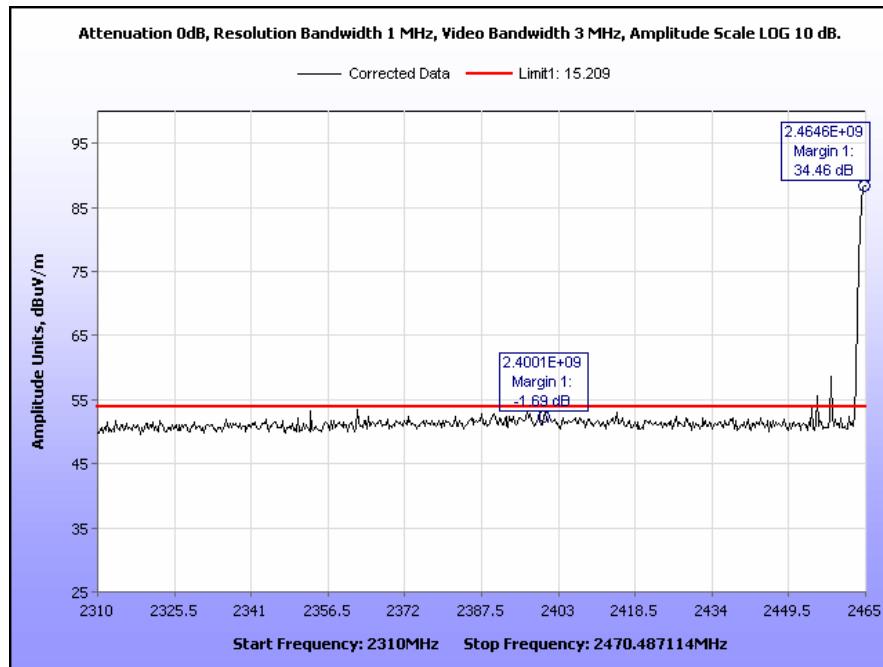
**Plot 19. Radiated Spurious Emissions, 2473 MHz, Peak under Average, 1 GHz – 18 GHz**



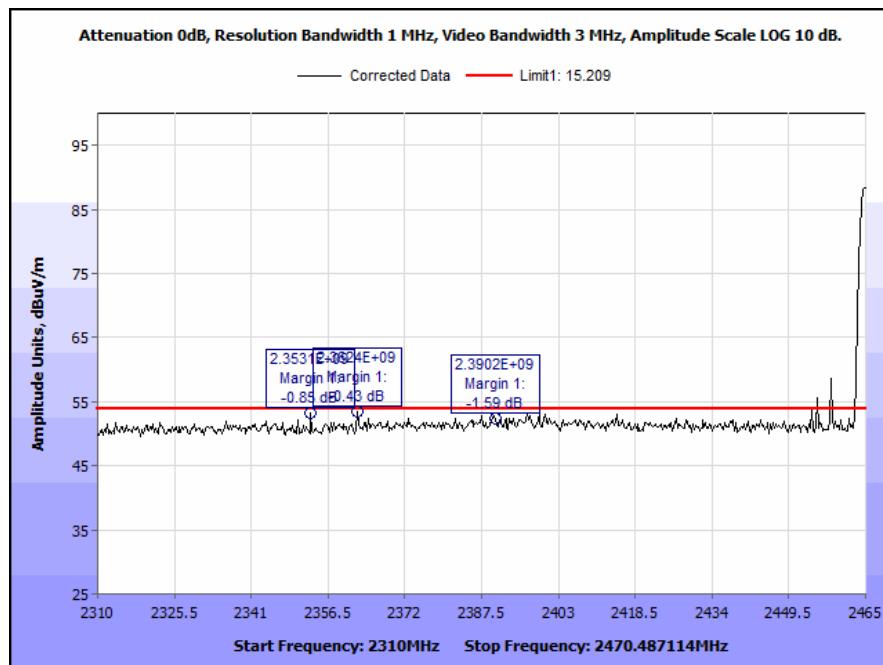
**Plot 20. Radiated Spurious Emissions, 2479 MHz, 30 MHz – 1 GHz**



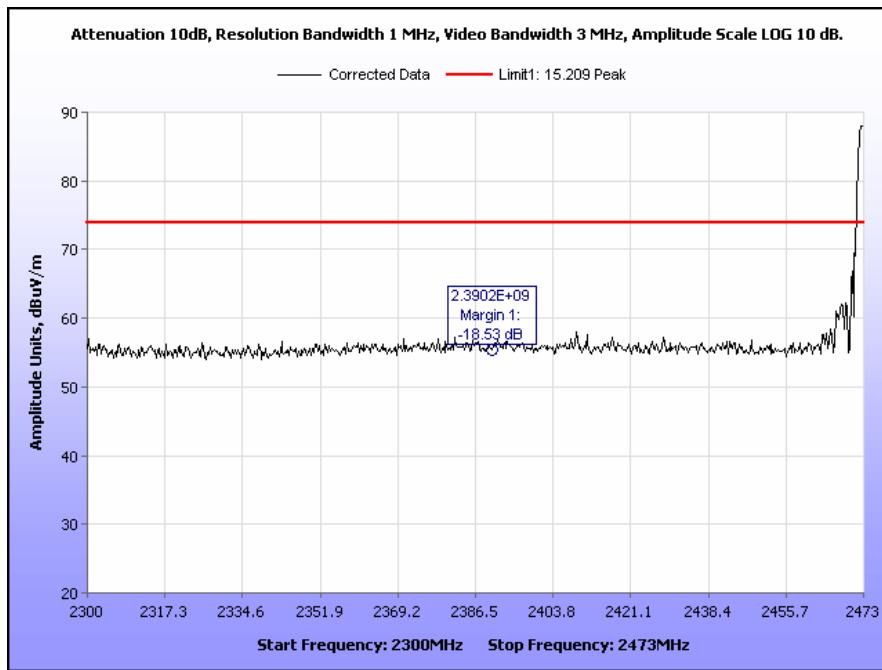
**Plot 21. Radiated Spurious Emissions, 2479 MHz, Peak under Average, 1 GHz – 18 GHz**



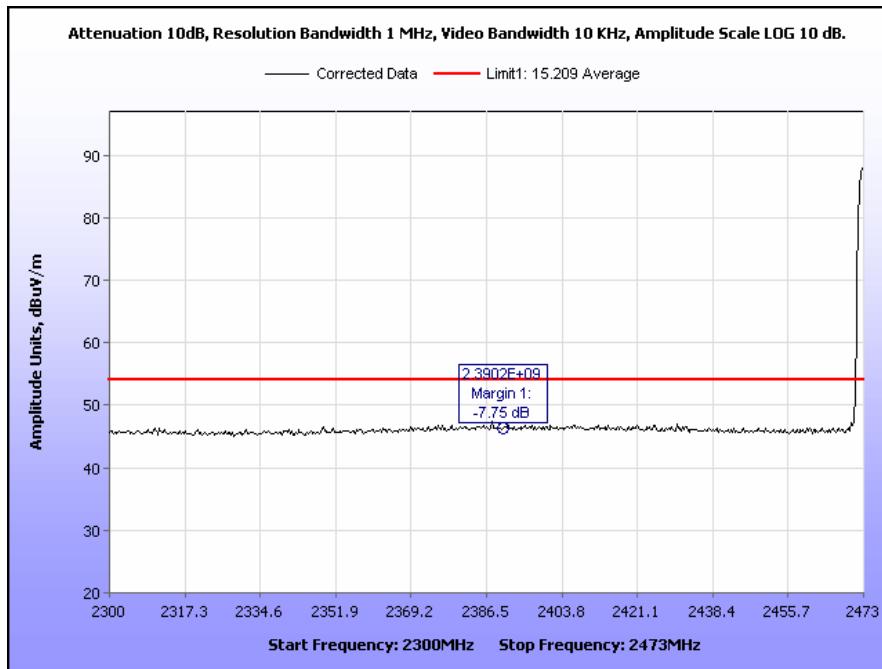
Plot 22. Restricted Band, 2465 MHz, Peak under Average



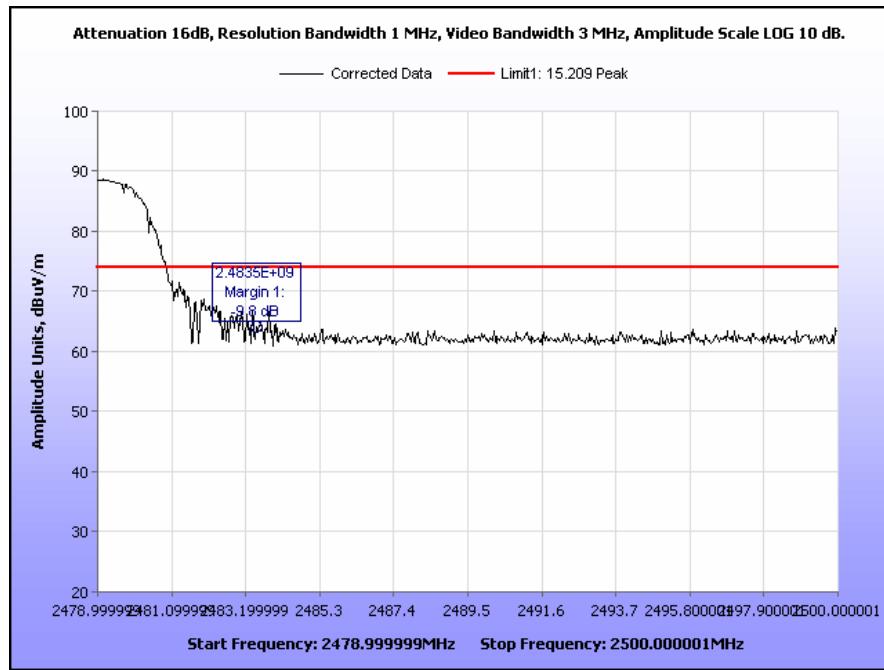
Plot 23. Restricted Band, 2471 MHz, Peak under Average



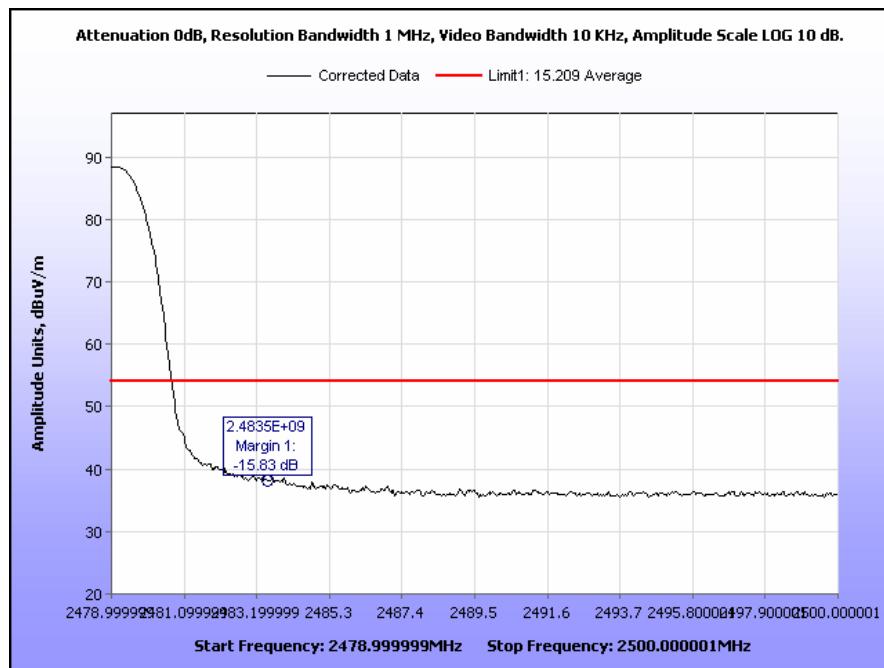
**Plot 24. Restricted Band, 2473 MHz, Peak**



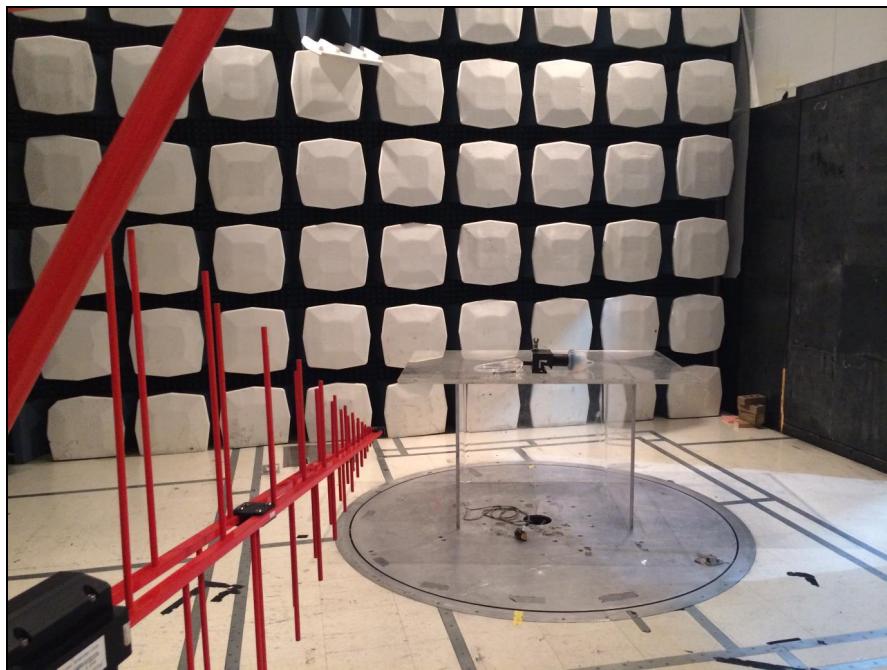
**Plot 25. Restricted Band, 2473 MHz, Average**



Plot 26. Restricted Band, 2479 MHz, Peak



Plot 27. Restricted Band, 2479 MHz, Average



Photograph 3. Radiated Spurious Emissions, Test Setup, 30 MHz – 1 GHz



Photograph 4. Radiated Spurious Emissions, Test Setup, 1 GHz – 18 GHz

## 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
1T4771	PSA SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4446A	02/15/2013	08/15/2014
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	7/16/2012	7/16/2014
1T4751	ANTENNA - BILOG	SUNOL SCIENCES	JB6	1/8/2013	7/8/2014
1T4483	ANTENNA; HORN	ETS-LINDGREN	3117	2/28/2014	8/28/2015
1T4745	ANTENNA, HORN	ETS-LINDGREN	3116	11/14/2013	11/14/2014
1T4300A	SEMI-ANECHOIC CHAMBER # 1 (FCC)	EMC TEST SYSTEMS	NONE	07/24/2012	07/24/2015
1T4442	PRE-AMPLIFIER, MICROWAVE	MITEQ	AFS42-01001800-30-10P	SEE NOTE	
1T4742	PRE-AMPLIFIER, HIGH-FREQUENCY	MITEQ	AFS42-01001800-30-10P-42	SEE NOTE	
1T4149	HIGH-FREQUENCY ANECHOIC CHAMBER	RAY-PROOF	81	NOT REQUIRED	

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



QinetiQ North America  
ASSY, Setup Tool

Electromagnetic Compatibility  
Certification & User's Manual Information  
CFR Title 47, Part 15B, 15.249; RSS-210, Issue 8, December 2010 & ICES-003

## 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 stages; 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.<sup>1</sup> *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.

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



## Certification & User's Manual Information

### § 2.948 Description of measurement facilities.

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



## Certification & User's Manual Information

### Label and User's Manual Information

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

#### § 15.19 Labeling requirements.

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

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

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

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

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

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

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

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

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

#### § 15.21 Information to user.

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



## Verification & User's Manual Information

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

### § 15.105 Information to the user.

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

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

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

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

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.



## ICES-003 Procedural & Labeling Requirements

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

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

### Procedural Requirements:

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

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

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

### Labeling Requirements:

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

This Class <sup>2</sup>] digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe <sup>1</sup>] est conforme à la norme NMB-003 du Canada.

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

# End of Report