**MET Laboratories, Inc.** *Safety Certification - EMI - Telecom Environmental Simulation*
3162 BELICK STREET • SANTA CLARA, CALIFORNIA 95054 • PHONE (510) 489-6300 • FAX (510) 489-6372

March 11, 2009

Echelon Corporation
550 Meridian Avenue
San Jose, CA 95126

Dear Yaqoob Bhimla,

Enclosed is the EMC Wireless test report for compliance testing of the Echelon Corporation, 3.1 2S ANSI Meter Model Number 83021-2IAAE with Radio Module IEEE 802.15.4 HAN CARD Model Number 79010-01 as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 15, Subpart B, ICES-003, Issue 4 February 2004 for a Class B Digital Device and FCC Part 15 Subpart C, RSS-210, Issue 7, June 2007 for Intentional Radiators..

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

Sincerely yours,
MET LABORATORIES, INC.

Jennifer Warnell
Documentation Department

Reference: (\Echelon Corporation\EMCS81280A-FCC247 Rev. 1)

MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
3162 BELICK STREET • SANTA CLARA, CALIFORNIA 95054 • PHONE (510) 489-6300 • FAX (510) 489-6372

# Electromagnetic Compatibility Criteria
# Test Report

for the

**Echelon Corporation**
**3.1 2S ANSI Meter Model Number 83021-2IAAE with Radio Module IEEE 802.15.4 HAN CARD Model Number 79010-01**

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

**MET Report: EMCS81280A-FCC247 Rev. 1**

March 11, 2009

**Prepared For:**

**Echelon Corporation**
**550 Meridian Avenue**
**San Jose, CA 95126**

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&
15.247 Subpart C & RSS-210, Issue 7, June 2007
for Intentional Radiators

Anderson Soungpanya, 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, 15.247 and Industry Canada standards ICES-003, Issue 4 February 2004, RSS-210, Issue 7, June 2007 under normal use and maintenance.

Shawn McMillen, Wireless Manager
Electromagnetic Compatibility Lab

  

# Report Status Sheet

| Revision | Report Date | Reason for Revision |
|---|---|---|
| ∅ | February 2, 2009 | Initial Issue. |
| 1 | March 11, 2009 | Editorial corrections. |

# Table of Contents

# List of Tables



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# List of Photographs

# List of Terms and Abbreviations

| | |
|---|---|
| **AC** | **A**lternating **C**urrent |
| **ACF** | **A**ntenna **C**orrection **F**actor |
| **Cal** | **Cal**ibration |
| ***d*** | **M**easurement **D**istance |
| **dB** | **D**eci**b**els |
| **dBµA** | **D**eci**b**els above one **micro**amp |
| **dBµV** | **D**eci**b**els above one **micro**volt |
| **dBµA/m** | **D**eci**b**els above one **micro**amp **per m**eter |
| **dBµV/m** | **D**eci**b**els above one **micro**volt **per m**eter |
| **DC** | **D**irect **C**urrent µ |
| **E** | **E**lectric Field |
| **DSL** | **D**igital **S**ubscriber **L**ine |
| **ESD** | **E**lectro**s**tatic **D**ischarge |
| **EUT** | **E**quipment **U**nder **T**est |
| ***f*** | **F**requency |
| **FCC** | **F**ederal **C**ommunications **C**ommission |
| **GR-1089-CORE** | ***(GR)*** **G**eneral **R**equirement(s) imposed by the NEBS standard, ***(CORE)*** **C**entral **O**ffice **R**ecovery **E**xpress (AT&T), ***(1089)*** specifies various parts of the General Requirements under Bellcore Technical Standard, Requirements for Electromagnetic Compatibility and Electrical Safety - Generic Criteria for Network Telecommunications Equipment |
| **GRP** | **G**round **R**eference **P**lane |
| **H** | Magnetic Field |
| **HCP** | **H**orizontal **C**oupling **P**lane |
| **Hz** | **H**ertz |
| **IEC** | **I**nternational **E**lectrotechnical **C**ommission |
| **kHz** | **k**ilo**h**ert**z** |
| **kPa** | **k**ilo**pa**scal |
| **kV** | **k**ilovolt |
| **LISN** | **L**ine **I**mpedance **S**tabilization **N**etwork |
| **MHz** | **M**ega**h**ertz |
| **µH** | **micro**henry |
| µ | **micro**farad |
| **µs** | **micros**econds |
| **NEBS** | **N**etwork **E**quipment-**B**uilding **S**ystem |
| **PRF** | **P**ulse **R**epetition **F**requency |
| **RF** | **R**adio **F**requency |
| **RMS** | **R**oot-**M**ean-**S**quare |
| **TWT** | **T**raveling **W**ave **T**ube |
| **V/m** | **V**olts **per m**eter |
| **VCP** | **V**ertical **C**oupling **P**lane |

# I. Executive Summary

## A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Echelon Corporation 3.1 2S ANSI Meter Model Number 83021-2IAAE with Radio Module IEEE 802.15.4 HAN CARD Model Number 79010-01, 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 3.1 2S ANSI Meter Model Number 83021-2IAAE with Radio Module IEEE 802.15.4 HAN CARD Model Number 79010-01. Echelon Corporation should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the 3.1 2S ANSI Meter Model Number 83021-2IAAE with Radio Module IEEE 802.15.4 HAN CARD Model Number 79010-01, 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 Echelon Corporation, purchase order number 23137. All tests were conducted using measurement procedure ANSI C63.4-2003.

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

**Table 1. Executive Summary of EMC Part 15.247 ComplianceTesting**

# II. Equipment Configuration

# A. Overview

MET Laboratories, Inc. was contracted by Echelon Corporation to perform testing on the 3.1 2S ANSI Meter Model Number 83021-2IAAE with Radio Module IEEE 802.15.4 HAN CARD Model Number 79010-01, under Echelon Corporation's purchase order number 23137.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Echelon Corporation, 3.1 2S ANSI Meter Model Number 83021-2IAAE with Radio Module IEEE 802.15.4 HAN CARD Model Number 79010-01.

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

| | | |
|---|---|---|
| **Model(s) Tested:** | 3.1 2S ANSI Meter Model Number 83021-2IAAE with Radio Module IEEE 802.15.4 HAN CARD Model Number 79010-01 | |
| **Model(s) Covered:** | 83021-2IAAE/79010-01 | |
| **EUT Specifications:** | Primary Power: 208 VAC, 60 Hz | |
| | FCC ID: IZP79010-01 | |
| | Type of Modulations: | DSSS (Direct Sequence Spread Spectrum) |
| | Equipment Code: | DTS |
| | Peak RF Output Power: | Low: 10.97 dBm |
| | | Mid: 19.02 dBm |
| | | High: -8.21 dBm |
| | EUT Frequency Ranges: | 2405-2480MHz |
| **Analysis:** | The results obtained relate only to the item(s) tested. | |
| **Environmental Test Conditions:** | Temperature: 15-35º C | |
| | Relative Humidity: 30-60% | |
| | Barometric Pressure: 860-1060 mbar | |
| **Evaluated by:** | Anderson Soungpanya | |
| **Date(s):** | March 11, 2009 | |

**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 7, June 2007** | Low-power Licence-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment |
| **CFR 47, Part 15, Subpart B** | Electromagnetic Compatibility: Criteria for Radio Frequency Devices |
| **ICES-003, Issue 4 February 2004** | Electromagnetic Compatibility: Criteria for Radio Frequency Devices |
| **ANSI C63.4:2003** | Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz |
| **ANSI/NCSL Z540-1-1994** | Calibration Laboratories and Measuring and Test Equipment - General Requirements |
| **ANSI/ISO/IEC 17025:2000** | General Requirements for the Competence of Testing and Calibration Laboratories |

**Table 3. References**

## C. Test Site

All testing was performed at MET Laboratories, Inc., 3162 Belick Street, Santa Clara, California 95054. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

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

## D. Description of Test Sample

The Echelon Corporation 3.1 2S ANSI Meter Model Number 83021-2IAAE with Radio Module IEEE 802.15.4 HAN CARD Model Number 79010-01, is a 802.15.4 radio modules with 100mW output power. Units have propreity interface.

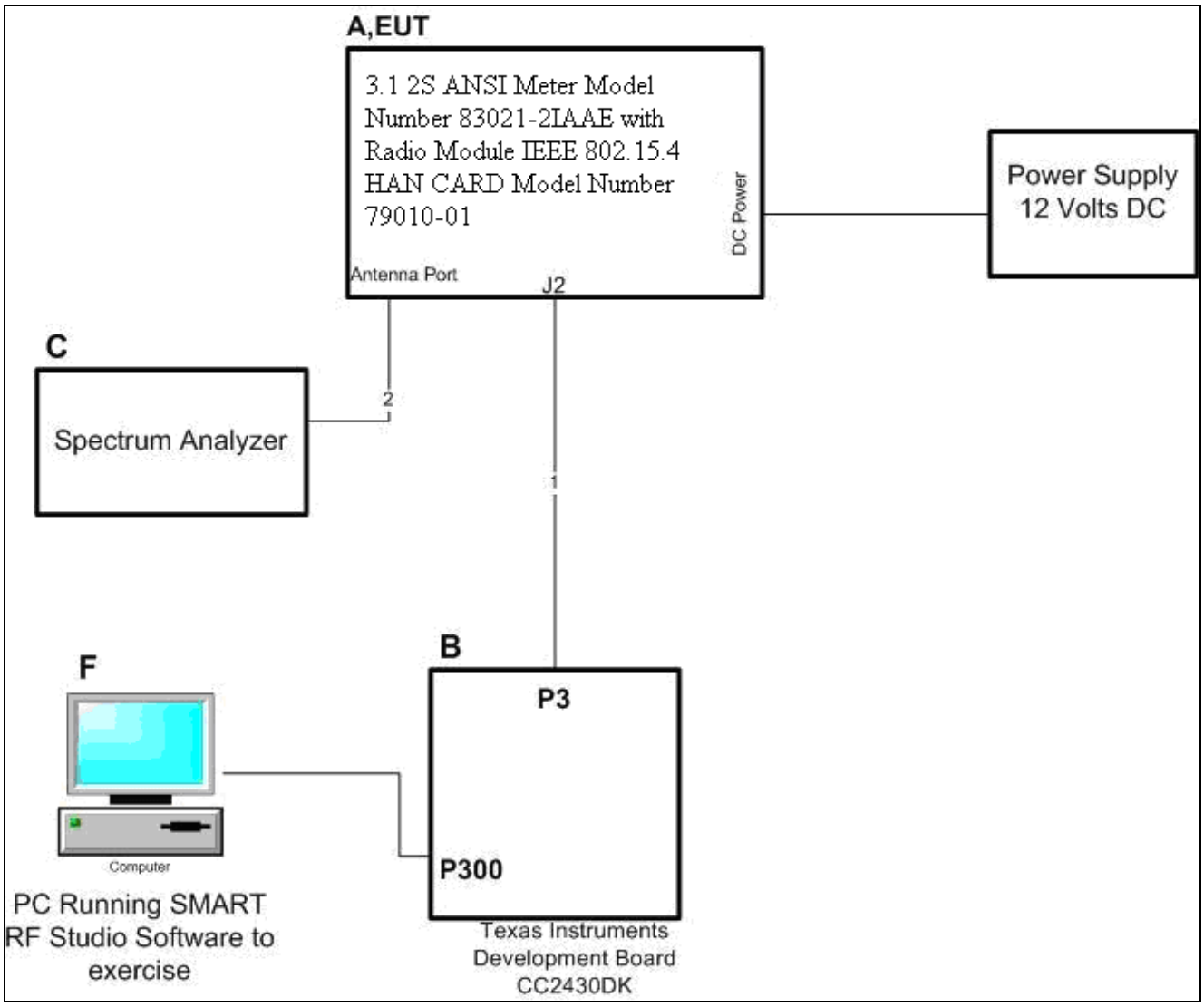



**Figure 1. Block Diagram of Test Configuration (Conducted Setup)**

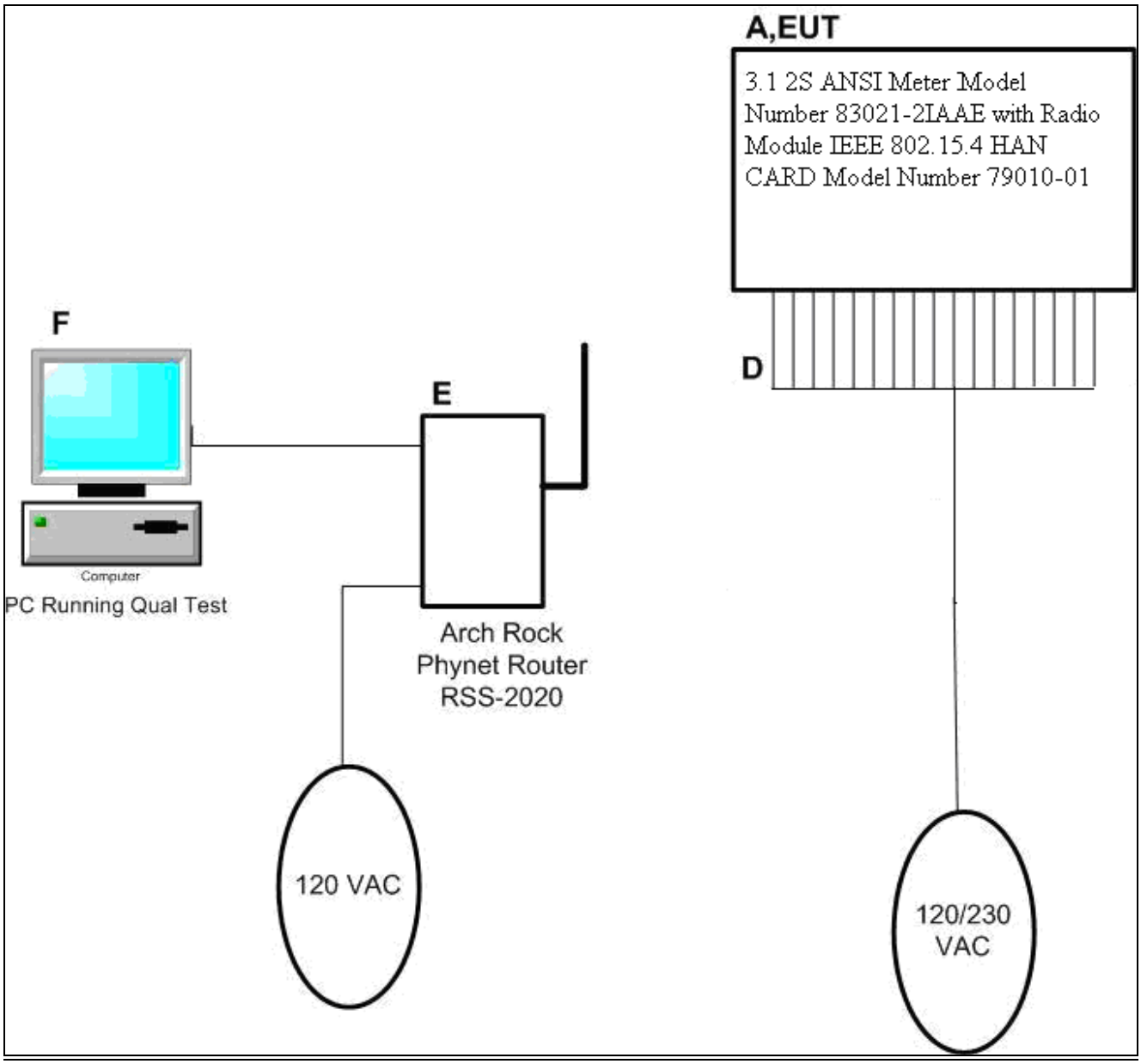



**Figure 2. Block Diagram of Test Configuration (Radiated Setup)**

## 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 | Rev. # |
|---|---|---|---|---|---|
| A | 3.1 2S ANSI METER MODEL NUMBER 83021-2IAAE WITH RADIO MODULE IEEE 802.15.4 HAN CARD MODEL NUMBER 79010-01 | 79010-01 | 825-0565-51 (ANSI) | 0531 / NR2 | N/A |

**Table 4. Equipment Configuration**

## E. Support Equipment

Echelon Corporation supplied support equipment necessary for the operation and testing of the 3.1 2S ANSI Meter Model Number 83021-2IAAE with Radio Module IEEE 802.15.4 HAN CARD Model Number 79010-01. All support equipment supplied is listed in the following Support Equipment List.

| Ref. ID | Name / Description | Manufacturer | Model Number | *Customer Supplied Calibration Data |
|---|---|---|---|---|
| F | PC | DELL | DCSM | N/A |
| E | PHYNET ROUTER | ARCH ROCK | RSS-2020 | N/A |
| B | DEVELOPMENT KIT | TEXAS INSTRUMENT | CC2430 | N/A |
| D | METER | ECHELON | GEN 3.1 | N/A |
| C | SPECTRUM ANALYZER | N/A | N/A | N/A |

**Table 5. Support Equipment**

* The 'Customer Supplied Calibration Data' column will be marked as either not applicable, not available, or will contain the calibration date supplied by the customer.

## F. Ports and Cabling Information

| Ref. ID | Port name on EUT | Cable Description or reason for no cable | Qty. | Length (m) | Shielded (Y/N) | Termination Box ID & Port Name |
|---|---|---|---|---|---|---|
| Conducted Radio Testing | | | | | | |
| 1 | J2 | DATA COMMUNICATION CABLE | 1 | 1 | N | EVALUATION BOARD |
| 2 | ANTENNA PORT | COAXIAL CABLE | 1 | 0.5 | Y | SPECTRUM ANALYZER |
| Radiated Radio Testing | | | | | | |
| 1 | J2 | DATA COMMUNICATION CABLE | 1 | 1 | N | EVALUATION BOARD |

**Table 6. Ports and Cabling Information**

## G. Mode of Operation

1. CW Mode
2. Full transceiver operation using propriety application code.

## H. Method of Monitoring EUT Operation

Qualification Test Software monitors and displays errors.

## 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 Echelon Corporation upon completion of testing.

# III. Electromagnetic Compatibility Criteria for Unintentional Radiators

## Electromagnetic Compatibility Criteria

## § 15.107 Conducted Emissions Limits

**Test Requirement(s):**

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

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

**15.207(a)**, Except as shown in paragraphs (b) and (c) of this section*, charging, AC adapters or battery eliminators the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the Table 7, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

| Frequency range (MHz) | Class A Conducted Limits (dBµV) | | *Class B Conducted Limits (dBµV) | |
|---|---|---|---|---|
| | Quasi-Peak | Average | Quasi-Peak | Average |
| * 0.15- 0.45 | 79 | 66 | 66 - 56 | 56 - 46 |
| 0.45 - 0.5 | 79 | 66 | 56 | 46 |
| 0.5 - 30 | 73 | 60 | 60 | 50 |

Note 1 — The lower limit shall apply at the transition frequencies.
Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz.
* -- Limits per Subsection 15.207(a).

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

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

**Test Engineer(s):** Anderson Soungpanya

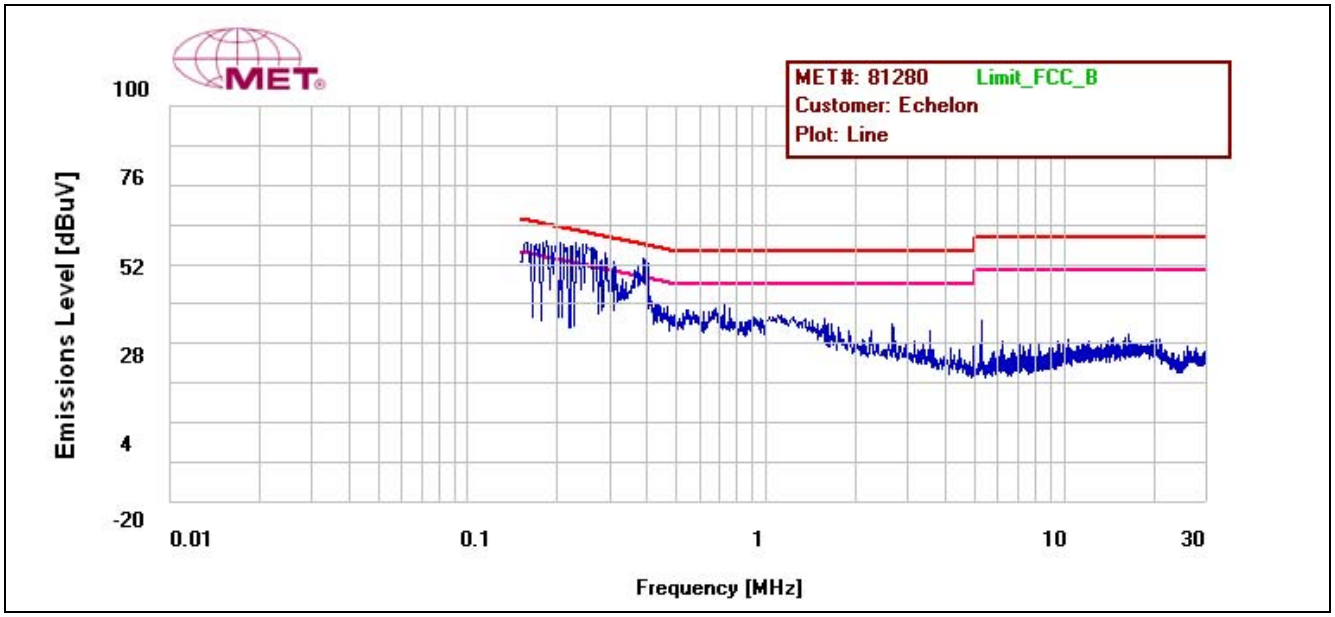
**Test Date(s):** 01/05/09

## Conducted Emissions - Voltage, AC Power, Phase Line 1 (208 VAC, 60 Hz)

| FREQ. (MHz) | Corrected Amplitude (dBuV) QP | Limit (dBuV) QP | Results QP | Margin (dB) QP | Corrected Amplitude (dBuV) AVG | Limit (dBuV) AVG | Results AVG | Margin (dB) AVG |
|---|---|---|---|---|---|---|---|---|
| .161 | 53.11 | 65.414 | Pass | -12.304 | 28.56 | 55.414 | Pass | -26.854 |
| .222 | 54.15 | 62.753 | Pass | -8.603 | 27.51 | 52.753 | Pass | -25.243 |
| .385 | 48.74 | 58.192 | Pass | -9.452 | 39.56 | 48.192 | Pass | -8.632 |

**Table 8. Conducted Emissions - Voltage, AC Power, Phase Line 1 (208 VAC, 60 Hz)**



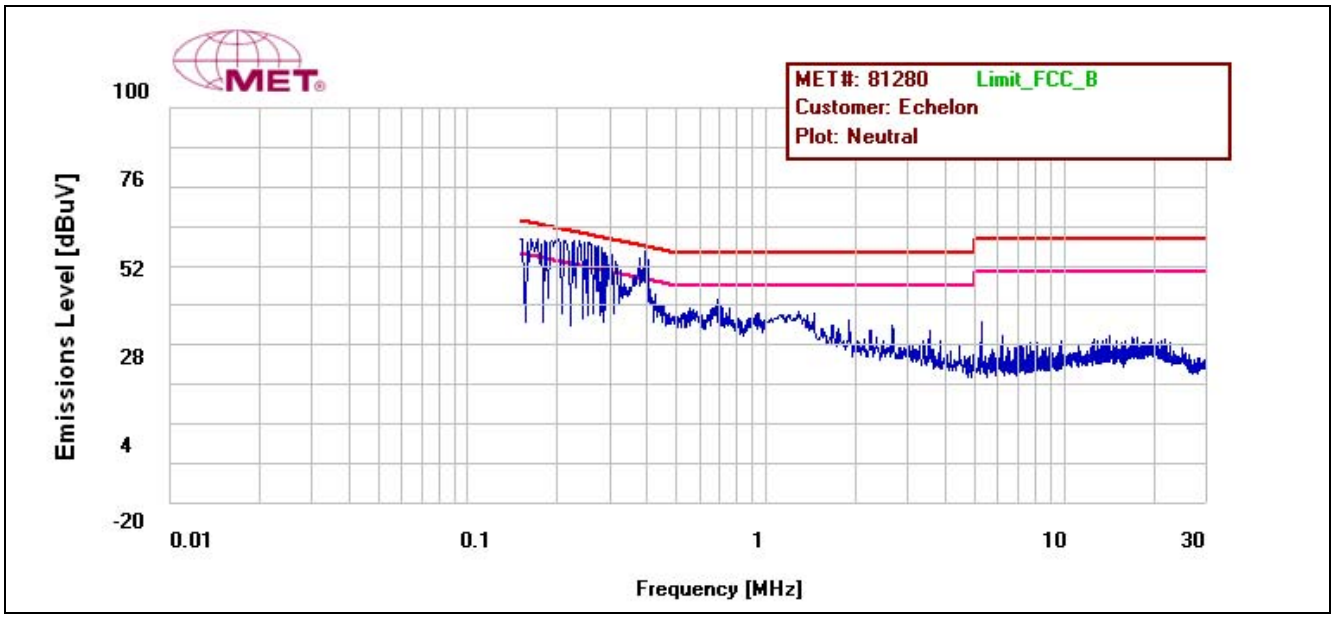

**Plot 1. Conducted Emission, Phase Line 1 Plot**

## Conducted Emissions - Voltage, AC Power, Phase Line 2 (208 VAC, 60 Hz)

| FREQ. (MHz) | Corrected Amplitude (dBuV) QP | Limit (dBuV) QP | Results QP | Margin (dB) QP | Corrected Amplitude (dBuV) AVG | Limit (dBuV) AVG | Results AVG | Margin (dB) AVG |
|---|---|---|---|---|---|---|---|---|
| .174 | 59.6 | 64.771 | Pass | -5.171 | 31.94 | 54.771 | Pass | -22.831 |
| .387 | 54.1 | 58.149 | Pass | -4.049 | 29.22 | 48.149 | Pass | -18.929 |
| 2.792 | 35.8 | 56 | Pass | -20.2 | 27.86 | 46 | Pass | -18.14 |

**Table 9. Conducted Emissions - Voltage, AC Power, Phase Line 2 (208 VAC, 60 Hz)**




**Plot 2. Conducted Emission, Phase Line 2 Plot**

## Conducted Emission Limits Test Setup

**Photograph 1. Conducted Emissions, Test Setup**

## Radiated Emission Limits

### § 15.109 Radiated Emissions Limits

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

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

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

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

**Test Procedures:** The EUT was placed on a 0.8m-high wooden table inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.4 were used. An antenna was located 10 m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1 m and 4 m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. Unless otherwise specified, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

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

**Test Engineer(s):** Anderson Soungpanya

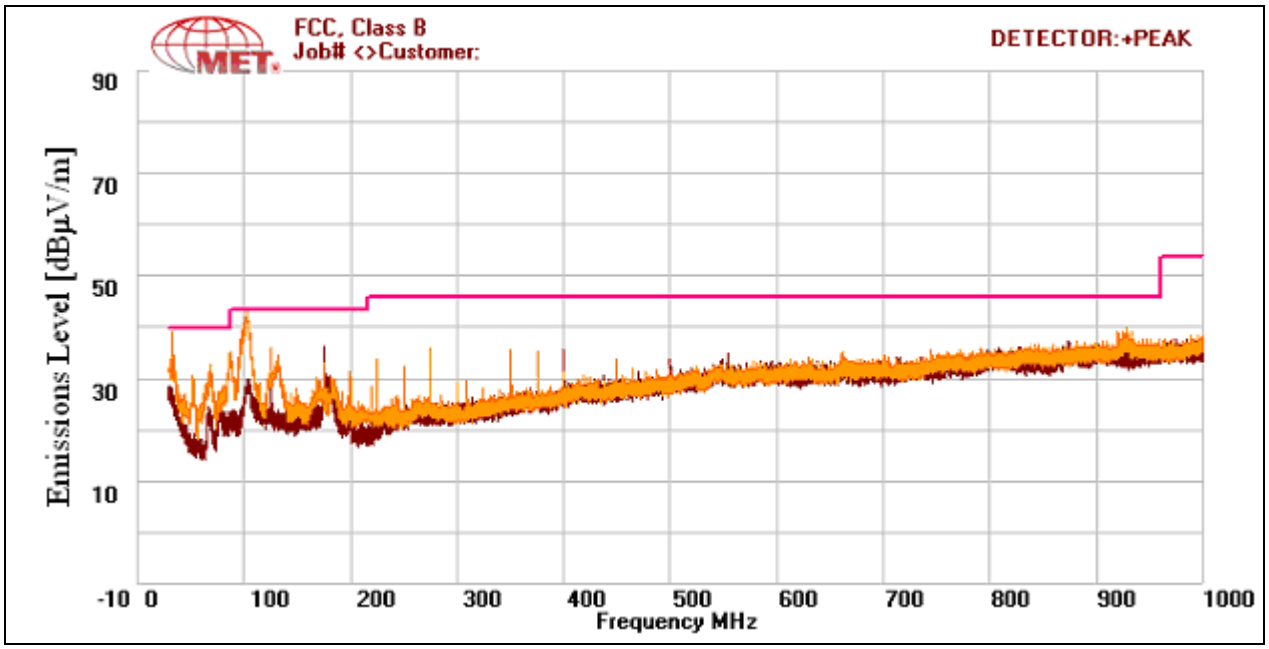
**Test Date(s):** 01/05/09

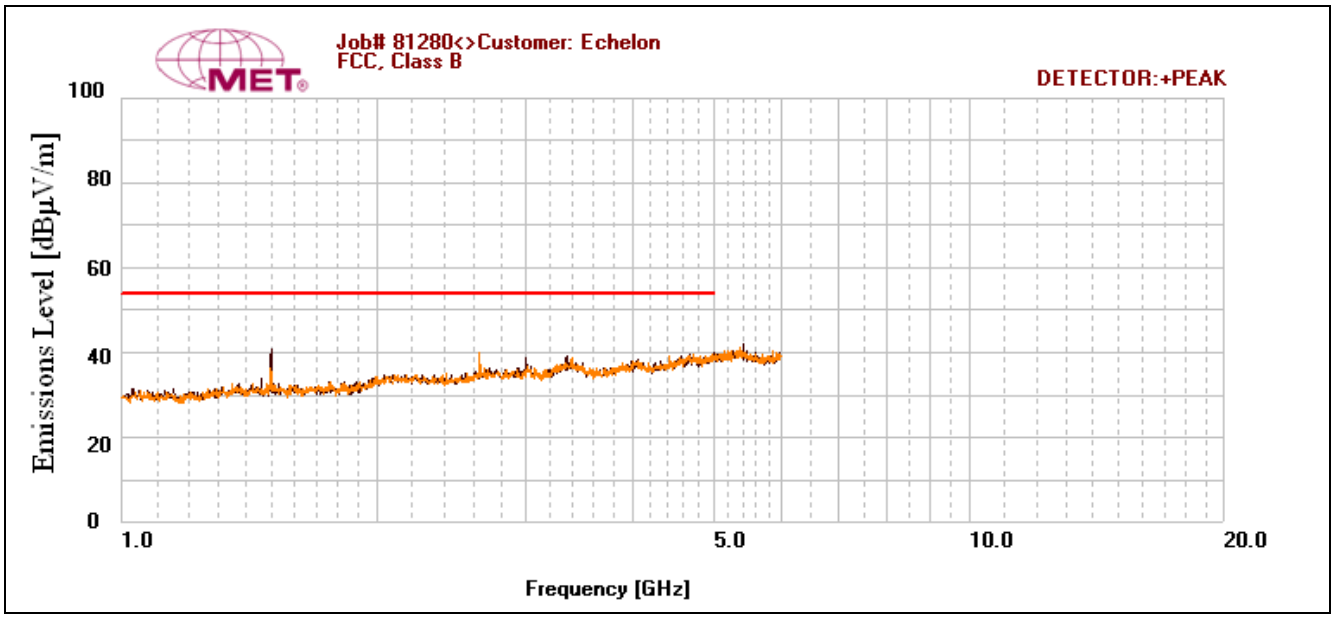
## Radiated Emissions Limits Test Results, Class B

| Frequency (MHz) | Antenna Polarity | EUT Azimuth (Degrees) | Antenna Height (cm) | Uncorrected Amplitude (dBuV) | ACF (dB/m) | Pre Amp Gain (dB) | CBL (dB) | DCF (dB) | Corrected Amplitude (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 102.44 | V | 222 | 151 | 17.1 | 11.039 | 0 | 1.664 | 10.46 | 40.263 | 43.5 | -3.237 |
| 33.2 | V | 198 | 100 | 9.21 | 15.64 | 0 | 0.954 | 10.46 | 36.264 | 40 | -3.736 |
| 125 | V | 218 | 100 | 10.14 | 12.3 | 0 | 1.752 | 10.46 | 34.652 | 43.5 | -8.848 |
| 274.96 | V | 220 | 100 | 9.51 | 13.499 | 0 | 2.718 | 10.46 | 36.187 | 46 | -9.813 |
| 349.95 | V | 283 | 100 | 7.54 | 14.598 | 0 | 3.081 | 10.46 | 35.679 | 46 | -10.321 |
| 174.97 | H | 69 | 400 | 18.81 | 9.601 | 0 | 2.275 | 10.46 | 41.146 | 43.5 | -2.354 |
| 1499 | H | 103 | 100 | 57.16 | -1.702 | 34.882 | 4.872 | 0 | 25.448 | 54 | -28.552 |
| 5000 | H | 0 | 100 | 41.2 | 7.8 | 34.4 | 11.1 | 0 | 25.7 | 54 | -28.3 |
| 5000 | V | 0 | 100 | 41.19 | 8 | 34.4 | 11.1 | 0 | 25.89 | 54 | -28.11 |

**Table 11. Radiated Emissions Limits, Test Results, 30 MHz – 5 GHz**




**Plot 3. Radiated Emissions, Pre-Scan, 30 MHz – 1 GHz**




**Plot 4. Radiated Emissions, Pre-Scan, 1GHz – 5 GHz**

**Photograph 2. Radiated Emission, Test Setup, 30 MHz - 5 GHz**

# IV. Electromagnetic Compatibility Criteria for Intentional Radiators

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.203 Antenna Requirement

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

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

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

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

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

**Results:** The EUT as tested meets the criteria of this rule by virtue of being permanently attached to the EUT. The EUT is therefore compliant with §15.203.

| Gain/Model | Manufacturer |
|---|---|
| 2.1dBi | Echelon |

**Test Engineer(s):** Edmund Cruz

**Test Date(s):** 11/25/08

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.207 Conducted Emissions Limits

**Test Requirement(s):** **§ 15.207 (a):** For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

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

**Table 12. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)**

**Test Procedure:** The EUT was placed on a 0.8 m-high wooden table inside a semi-anechoic chamber. The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a 50 Ω/50 μH Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.4-1992 "Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz"*. The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω/50 μH LISN as the input transducer to an EMC/field intensity meter. The tests were conducted in a RF-shielded enclosure.

**Test Results:** The EUT is compliant with this requirement.

**Test Engineer(s):** Anderson Soungpanya

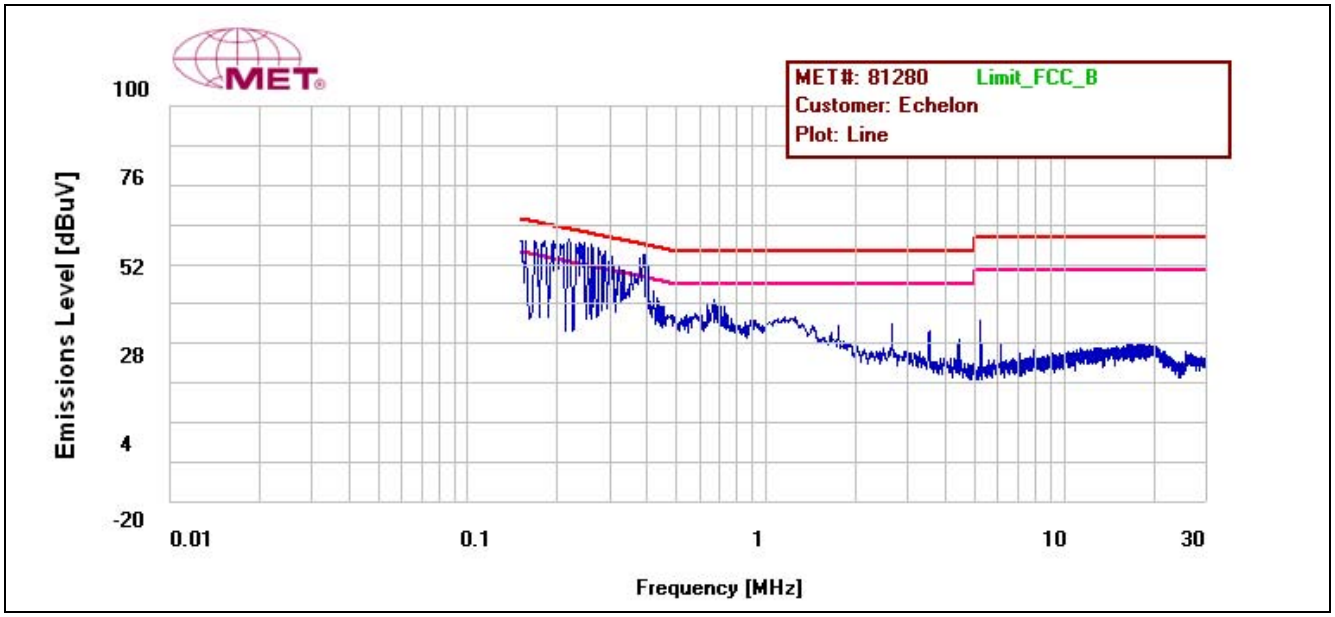
**Test Date(s):** 01/05/09

## Conducted Emissions - Voltage, AC Power, Phase Line 1 (208 VAC, 60 Hz)

| FREQ. (MHz) | Corrected Amplitude (dBuV) QP | Limit (dBuV) QP | Results QP | Margin (dB) QP | Corrected Amplitude (dBuV) AVG | Limit (dBuV) AVG | Results AVG | Margin (dB) AVG |
|---|---|---|---|---|---|---|---|---|
| .161 | 54.01 | 65.414 | Pass | -11.404 | 28.25 | 55.414 | Pass | -27.164 |
| .210 | 53.75 | 63.213 | Pass | -9.463 | 28.11 | 53.213 | Pass | -25.103 |
| .383 | 48.12 | 58.235 | Pass | -10.115 | 39.71 | 48.235 | Pass | -8.525 |

**Table 13. Conducted Emissions - Voltage, AC Power, Phase Line 1 (208 VAC, 60 Hz)**

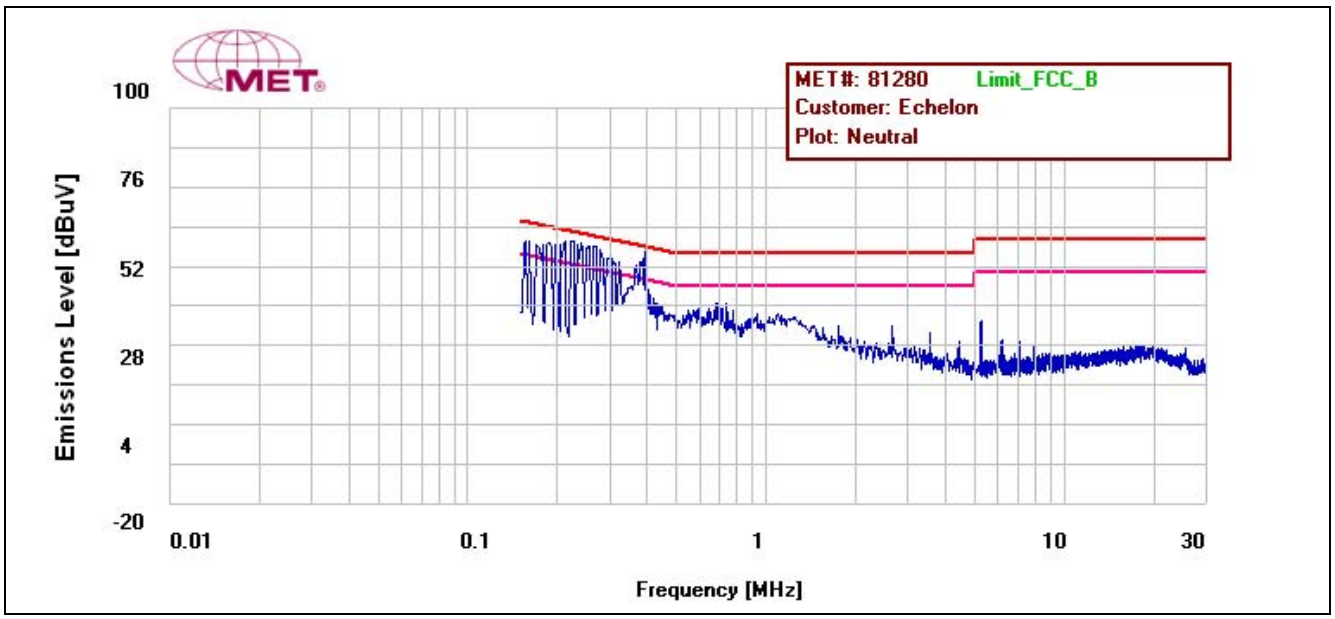



**Plot 5. Conducted Emission, Phase Line 1 Plot**

## Conducted Emissions - Voltage, AC Power, Phase Line 2 (208 VAC, 60 Hz)

| FREQ. (MHz) | Corrected Amplitude (dBuV) QP | Limit (dBuV) QP | Results QP | Margin (dB) QP | Corrected Amplitude (dBuV) AVG | Limit (dBuV) AVG | Results AVG | Margin (dB) AVG |
|---|---|---|---|---|---|---|---|---|
| .198 | 53.76 | 63.7 | Pass | -9.94 | 27.88 | 53.7 | Pass | -25.82 |
| .226 | 53.55 | 62.605 | Pass | -9.055 | 27.51 | 52.605 | Pass | -25.095 |
| .386 | 48.89 | 58.171 | Pass | -9.281 | 40.27 | 48.171 | Pass | -7.901 |

**Table 14. Conducted Emissions - Voltage, AC Power, Phase Line 2 (208 VAC, 60 Hz)**




**Plot 6. Conducted Emission, Phase Line 2 Plot**

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(a) 6 dB and 99% Bandwidth

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

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

**Test Procedure:** The transmitter was set to the low, mid & high channels at the highest output power and connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately 1% of the total emission bandwidth, VBW > RBW. The 6 dB Bandwidth was measured and recorded. The measurements were repeated at the low and high channels.

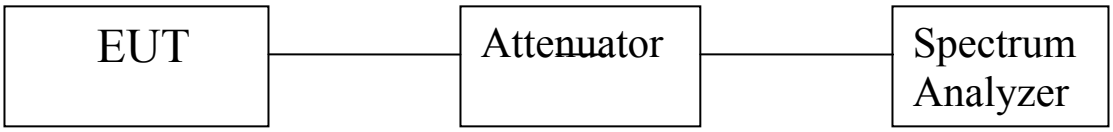
**Test Results** Equipment complies with § 15.247 (a). The 6 dB and 99% Bandwidth was determined from the plots on the following pages.

| 802.15.4 mode | | | |
|---|---|---|---|
| **Carrier Channel** | **Frequency (MHz)** | **Measured 6 dB Bandwidth (MHz)** | **Measured 99% Bandwidth (MHz)** |
| Low | 2405 | 1.358 | 2.5591 |
| Mid | 2440 | 1.579 | 2.4754 |
| High | 2480 | 1.441 | 2.5472 |

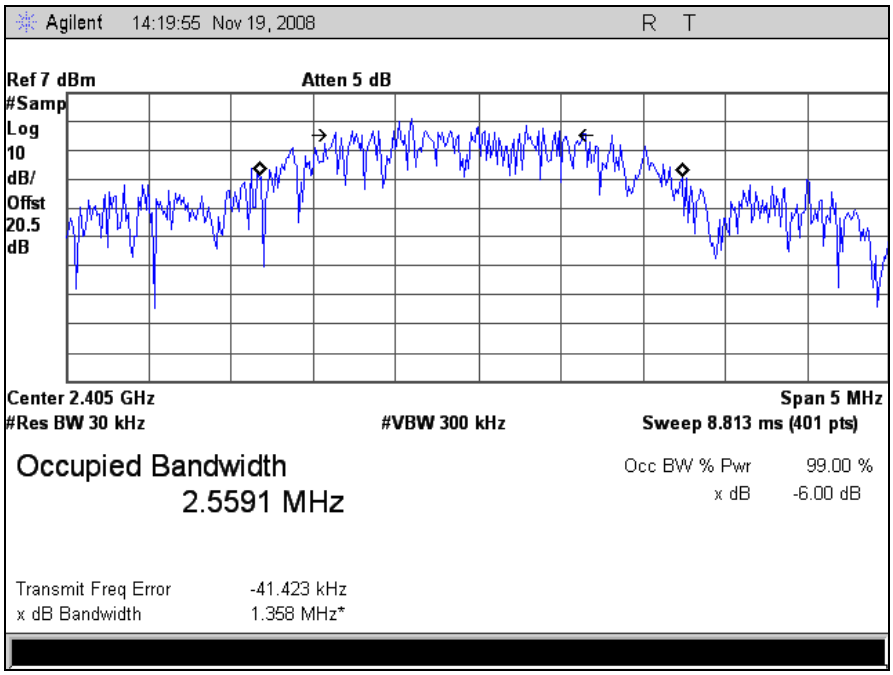
**Test Engineer(s):** Edmund Cruz

**Test Date(s):** 11/25/08

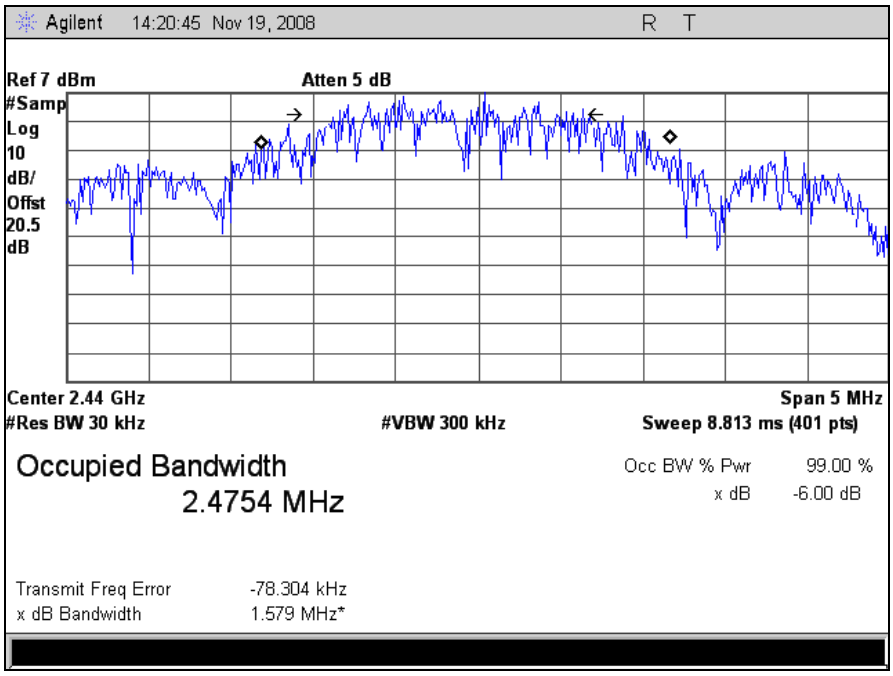



**Block Diagram 1. Occupied Bandwidth Test Setup**

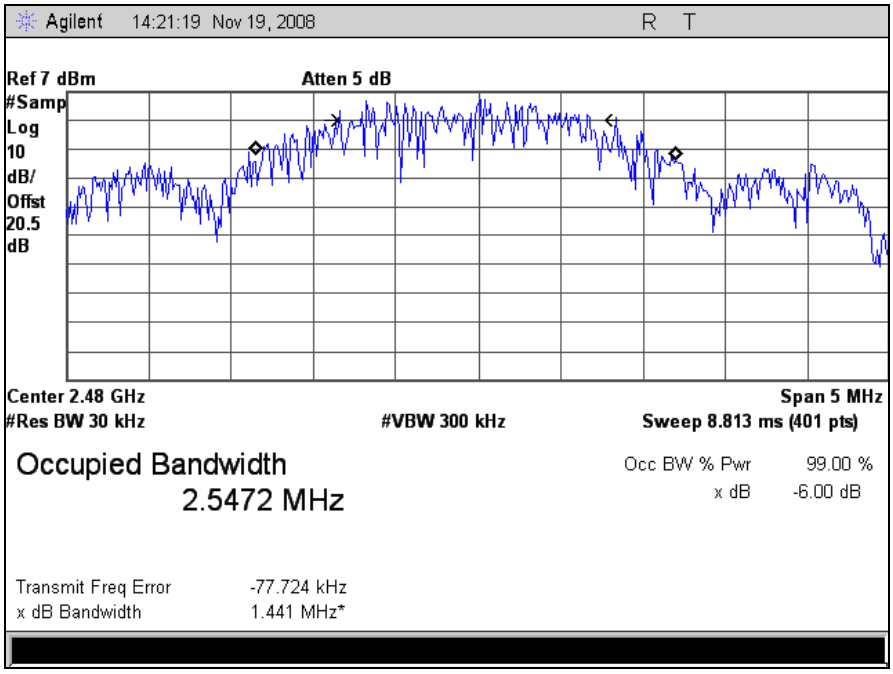



**Plot 7. Low Channel, Occupied Band Width**




**Plot 8. Mid Channel, Occupied Band Width**




**Plot 9. High Channel, Occupied Band Width**

# Electromagnetic Compatibility Criteria for Intentional Radiators

## § 15.247(b) Peak Power Output and RF Exposure

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

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

**Table 15. Output Power Requirements from §15.247**

**§15.247(c):** if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in the Table 15, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400 – 2483.5 MHz band may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

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

**Test Procedure:** The transmitter was connected to a calibrated Spectrum Analyzer. The EUT was measured at the low, mid and high channels of each band at a data rate which gave the maximum power level.

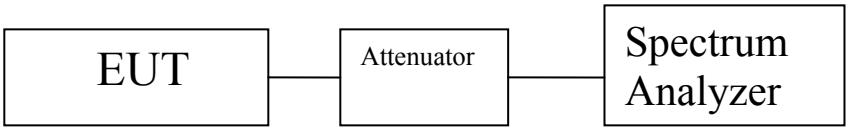
  

**Test Results:** Equipment complies with the Peak Power Output limits of **§ 15.247(b)**.

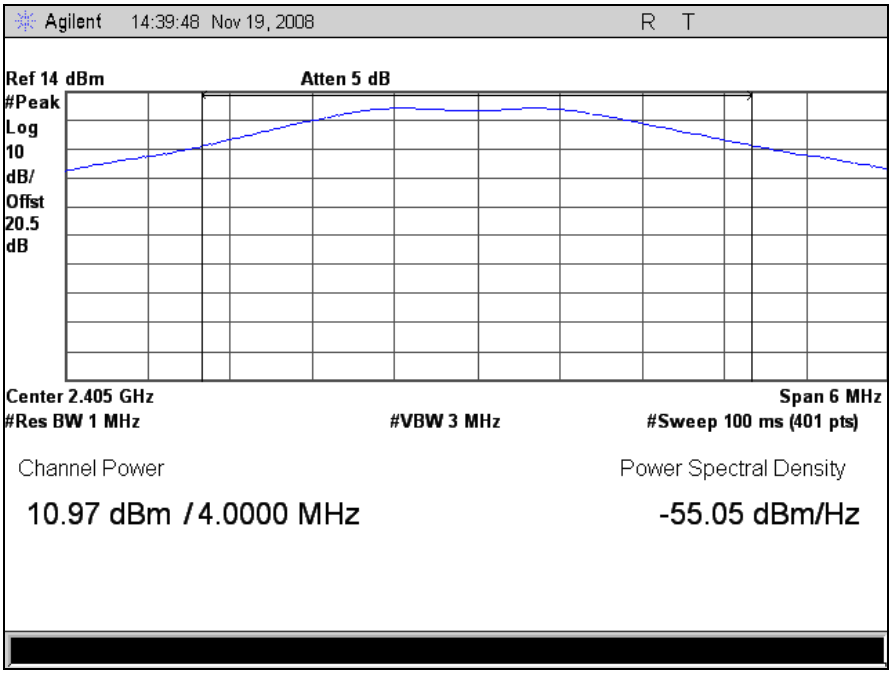
| 802.15.4 | | | |
|---|---|---|---|
| **Carrier Channel** | **Frequency (MHz)** | **Measured Peak Output Power dBm** | **Channel** |
| 11 | 2405 | 10.97 | Low |
| 18 | 2440 | 19.02 | Mid |
| 26 | 2480 | -8.21 | High |

**Test Engineer(s):** Eric Cruz

**Test Date(s):** 11/25/08

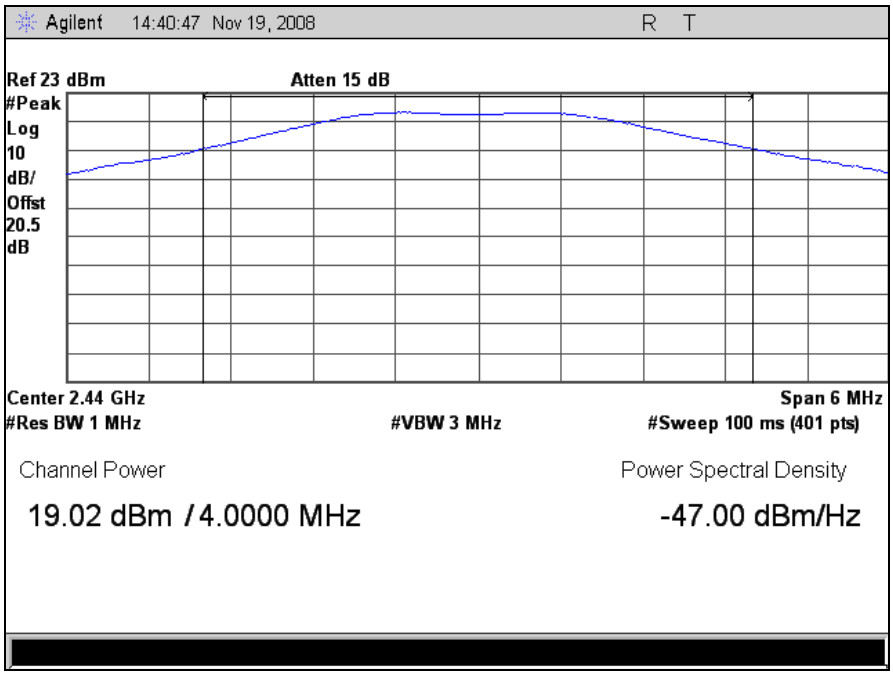



**Block Diagram 2. Peak Power Output Test Setup**

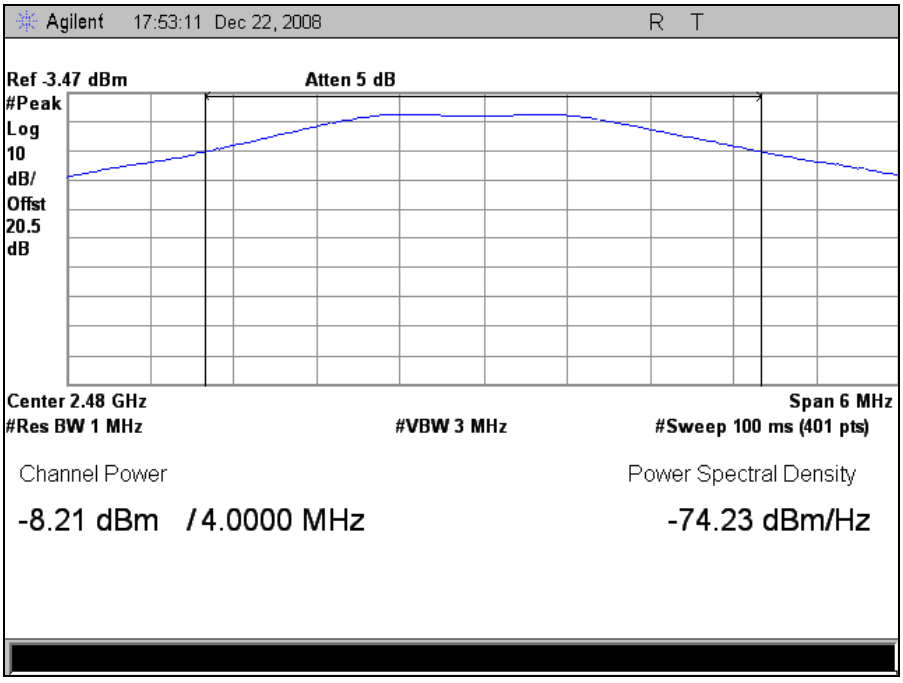



**Plot 10. Low Channel, Peak Power**




**Plot 11. Mid Channel, Peak Power**




**Plot 12. High Channel, Peak Power**

# Electromagnetic Compatibility Criteria for Intentional Radiators

## § 15.247(b) Peak Power Output and RF Exposure

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

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

MPE Limit Calculation: EUT's operating frequencies @ 2400-2483.5 MHz; highest conducted power = 19.02dBm (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm$^2$ or 10 W/m$^2$**

EUT maximum antenna gain = 2.1 dBi.

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

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

where, S = Power Density (1 mW/cm$^2$)
P = Power Input to antenna (83.17mW)
G = Antenna Gain (1.62 numeric)

$R = (83.17*1.62/ 4*3.14*1.0)^{1/2} = (134.90 / 12.56)^{1/2} = 3.28$cm
$S = (83.17*1.62 / 4*3.14*20.0^2) = (134.90/ 5024) =$ **0.0268 mW/cm$^2$**@ 20cm separation

# Electromagnetic Compatibility Criteria for Intentional Radiators

## § 15.247(d) Harmonic Emissions – Radiated

**Test Requirements:** **§15.249(d)**; **§15.205, §15.209:** Emissions outside the frequency band.

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

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

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090–0.110---------- | 16.42–16.423 | 399.9–410 | 4.5–5.15 |
| [1] 0.495–0.505---------- | 16.69475–16.69525 | 608–614 | 5.35–5.46 |
| 2.1735–2.1905---------- | 16.80425–16.80475 | 960–1240 | 7.25–7.75 |
| 4.125–4.128---------- | 25.5–25.67 | 1300–1427 | 8.025–8.5 |
| 4.17725–4.17775---------- | 37.5–38.25 | 1435–1626.5 | 9.0–9.2 |
| 4.20725–4.20775---------- | 73–74.6 | 1645.5–1646.5 | 9.3–9.5 |
| 6.215–6.218---------- | 74.8–75.2 | 1660–1710 | 10.6–12.7 |
| 6.26775–6.26825---------- | 108–121.94 | 1718.8–1722.2 | 13.25–13.4 |
| 6.31175–6.31225---------- | 123–138 | 2200–2300 | 14.47–14.5 |
| 8.291–8.294---------- | 149.9–150.05 | 2310–2390 | 15.35–16.2 |
| 8.362–8.366---------- | 156.52475–156.52525 | 2483.5–2500 | 17.7–21.4 |
| 8.37625–8.38675---------- | 156.7–156.9 | 2655–2900 | 22.01–23.12 |
| 8.41425–8.41475---------- | 162.0125–167.17 | 3260–3267 | 23.6–24.0 |
| 12.29–12.293---------- | 167.72–173.2 | 3332–3339 | 31.2–31.8 |
| 12.51975–12.52025---------- | 240–285 | 3345.8–3358 36. | 43–36.5 |
| 12.57675–12.57725---------- | 322–335.4 | 3600–4400 | ([2]) |

**Table 16. Restricted Bands of Operation**

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

**Test Procedures:** The transmitter was set to the low, mid and high channels at the highest output power and placed on a 0.8 m high wooden table inside in a semi-anechoic chamber. Measurements were performed with the EUT rotated 360 degrees and varying the adjustable antenna mast with 1 m to 4 m height to determine worst case orientation for maximum emissions. An RF filter was used to attenuate the fundamental carrier prior to the pre-amplification stage.

Restricted Band Edge Measurement Procedure:

STEP 1 - The field strength of the fundamental emission was measured using a 1MHz RBW and a 3MHz VBW for the peak value and a 1MHz RBW and a 10Hz VBW for the average value.

STEP 2 – A spectrum analyzer span was incorporated to encompass both the peak of the fundamental emission and the band edge emission under investigation. The RBW was set to 30 kHz and the VBW to 3x the RBW. The delta between the peak levels of the fundamental emission at the relevant band edge emission was measured and recorded.

STEP 3 – The resulting delta value was used to determine compliance.

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

**Test Engineer(s):** Anderson Soungpanya

**Test Date(s):** 11/18/08 - 12/23/08

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(d) Harmonic Emissions Requirements – Radiated

| Freq. | Antenna Polarity | Raw Amp. @ 3 m | P.Amp | Ant. Cor. Factor | Cable Loss | EUT Field Strength Final Amp. | Limit Detector Peak / Avg | Limit @ 3 m | Delta |
|---|---|---|---|---|---|---|---|---|---|
| (GHz) | (H/V) | (Peak) / (Avg) | (dB) | (dB/m) | (dB) | (dBuV/m) | (Peak) / (Avg) | (dBuV/m) | (dB) |
| 4.81 | V | 48.83 | 34.76 | 33.27 | 7.78 | 55.11 | Peak | 74 | -18.89 |
| 4.81 | V | 37.2 | 34.76 | 33.27 | 7.78 | 43.48 | Avg | 54 | -10.52 |
| 7.215 | V | 44.7 | 35.01 | 35.73 | 10.43 | 55.85 | Peak | 74 | -18.15 |
| 7.215 | V | 31.85 | 35.01 | 35.73 | 10.43 | 43.00 | Avg | 54 | -11.00 |
| 9.62 | V | 44.89 | 35.59 | 37.74 | 10.78 | 57.82 | Peak | 74 | -16.18 |
| 9.62 | V | 31.9 | 35.59 | 37.74 | 10.78 | 44.83 | Avg | 54 | -9.17 |

**Table 17. Harmonic Radiated Emissions, Low Channel**

| Freq. | Antenna Polarity | Raw Amp. @ 3 m | P.Amp | Ant. Cor. Factor | Cable Loss | EUT Field Strength Final Amp. | Limit Detector Peak / Avg | Limit @ 3 m | Delta |
|---|---|---|---|---|---|---|---|---|---|
| (GHz) | (H/V) | (Peak) / (Avg) | (dB) | (dB/m) | (dB) | (dBuV/m) | (Peak) / (Avg) | (dBuV/m) | (dB) |
| 4.88 | V | 47.31 | 34.74 | 33.45 | 7.80 | 53.82 | Peak | 74 | -20.18 |
| 4.88 | V | 35 | 34.74 | 33.45 | 7.80 | 41.51 | Avg | 54 | -12.49 |
| 7.32 | V | 43.72 | 35.03 | 36.01 | 10.67 | 55.38 | Peak | 74 | -18.62 |
| 7.32 | V | 31.04 | 35.03 | 36.01 | 10.67 | 42.70 | Avg | 54 | -11.30 |
| 9.76 | V | 44.95 | 35.55 | 37.97 | 10.89 | 58.26 | Peak | 74 | -15.74 |
| 9.76 | V | 31.82 | 35.55 | 37.97 | 10.89 | 45.13 | Avg | 54 | -8.87 |

**Table 18. Harmonic Radiated Emissions, Mid Channel**

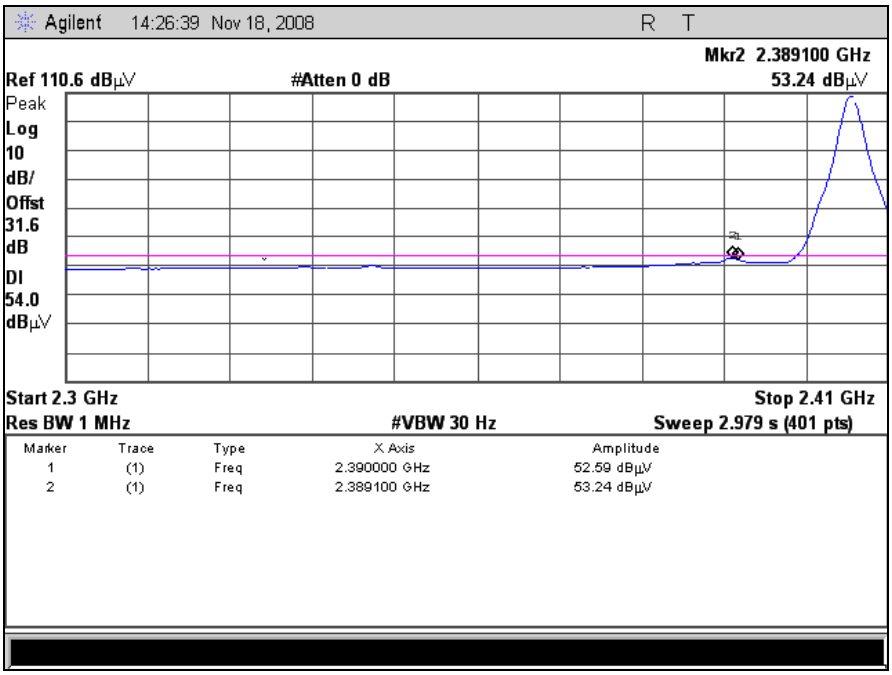
Note: All other emissions were measured at the noise floor of the spectrum analyzer

| Freq. | Antenna Polarity | Raw Amp. @ 3 m | P.Amp | Ant. Cor. Factor | Cable Loss | EUT Field Strength Final Amp. | Limit Detector Peak / Avg | Limit @ 3 m | Delta |
|---|---|---|---|---|---|---|---|---|---|
| (GHz) | (H/V) | (Peak) / (Avg) | (dB) | (dB/m) | (dB) | (dBuV/m) | (Peak) / (Avg) | (dBuV/m) | (dB) |
| 4.96 | V | 43.73 | 34.72 | 33.63 | 7.86 | 50.50 | Peak | 74 | -23.50 |
| 4.96 | V | 30.97 | 34.72 | 33.63 | 7.86 | 37.74 | Avg | 54 | -16.26 |
| 7.44 | V | 43.89 | 35.08 | 36.29 | 10.87 | 55.97 | Peak | 74 | -18.03 |
| 7.44 | V | 31.2 | 35.08 | 36.29 | 10.87 | 43.28 | Avg | 54 | -10.72 |
| 9.92 | V | 44.7 | 35.54 | 38.23 | 11.02 | 58.41 | Peak | 74 | -15.59 |
| 9.92 | V | 32.2 | 35.54 | 38.23 | 11.02 | 45.91 | Avg | 54 | -8.09 |

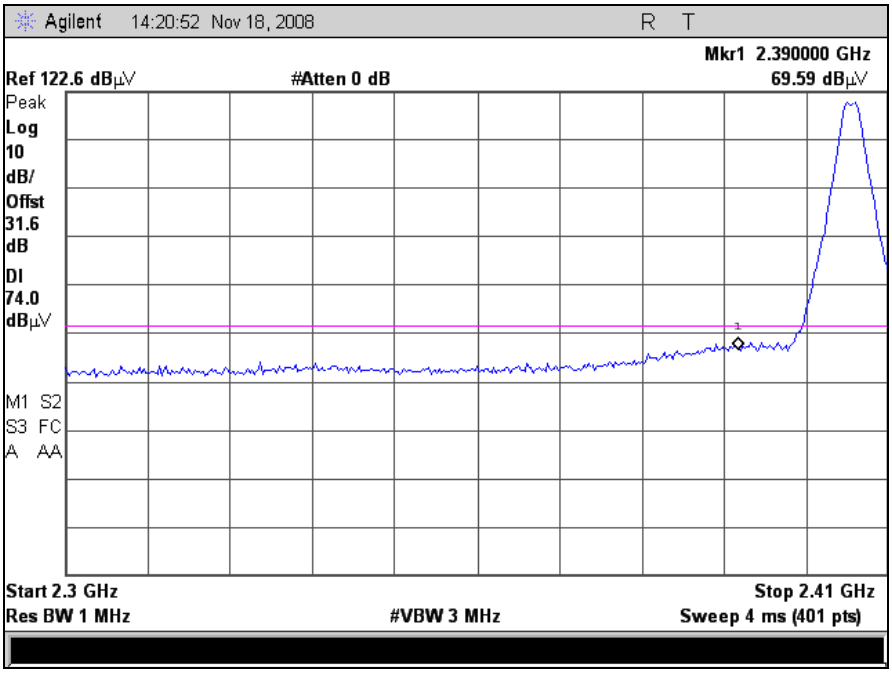
**Table 19. Harmonic Radiated Emissions, High Channel**

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

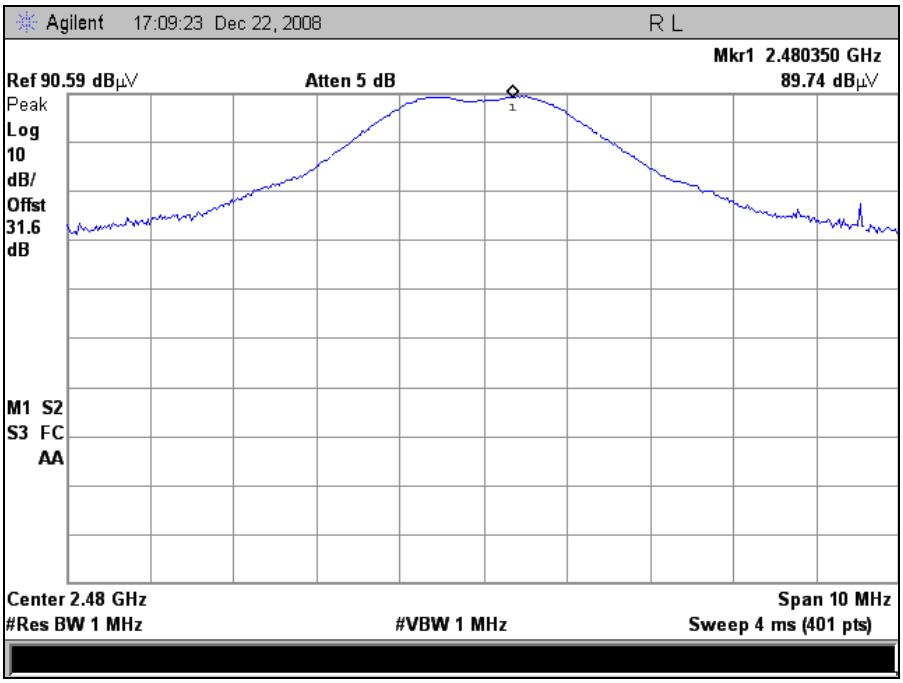
## Electromagnetic Compatibility Criteria for Intentional Radiators
## Radiated Band Edge Plots



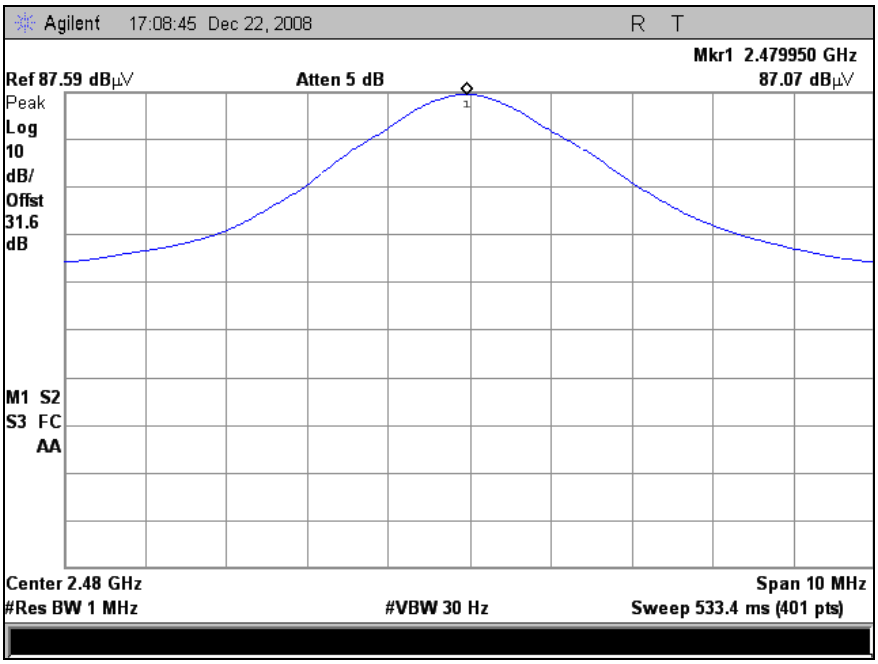

**Plot 13. Radiated Band Edge, Low Channel, Average**




**Plot 14. Radiated Band Edge, Low Channel, Peak**

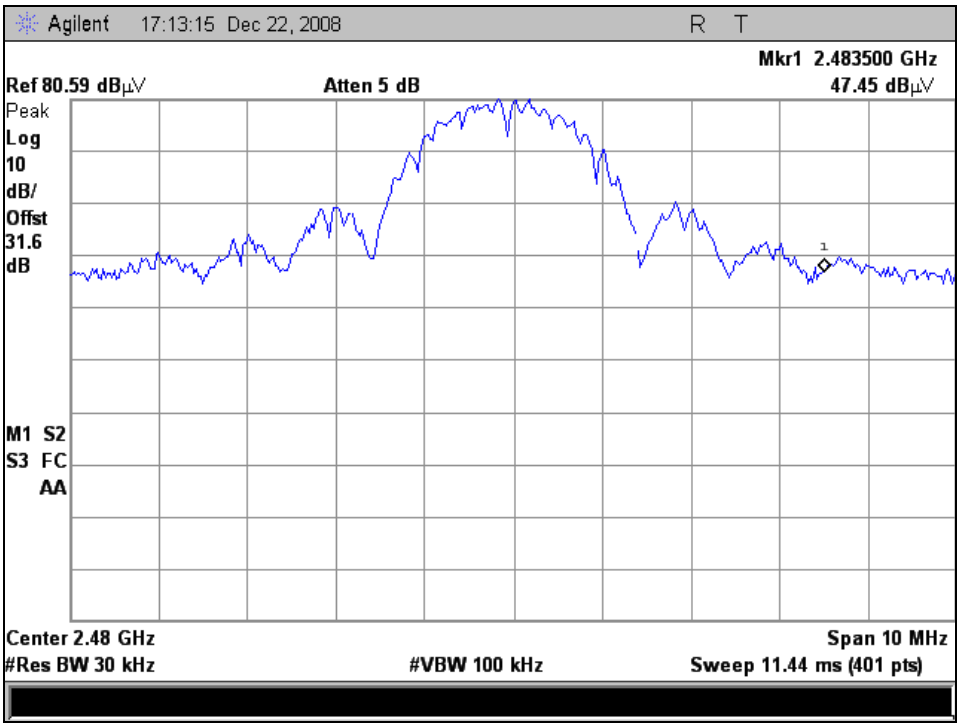



**Plot 15. Radiated Band Edge, In Band Peak Measurement**



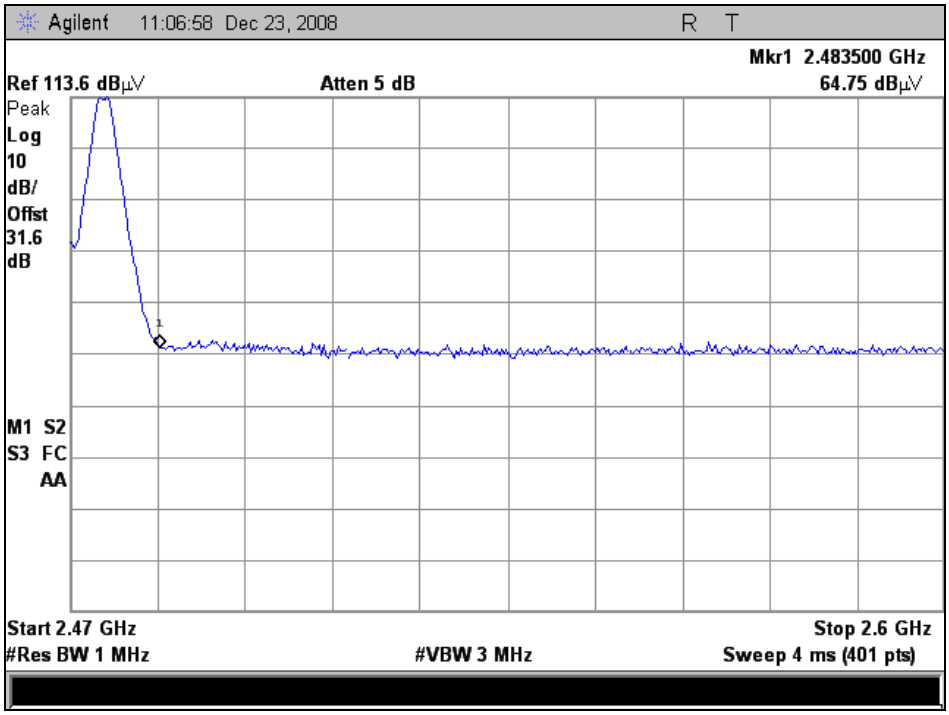

**Plot 16. Radiated Band Edge, In Band Average Measurement**

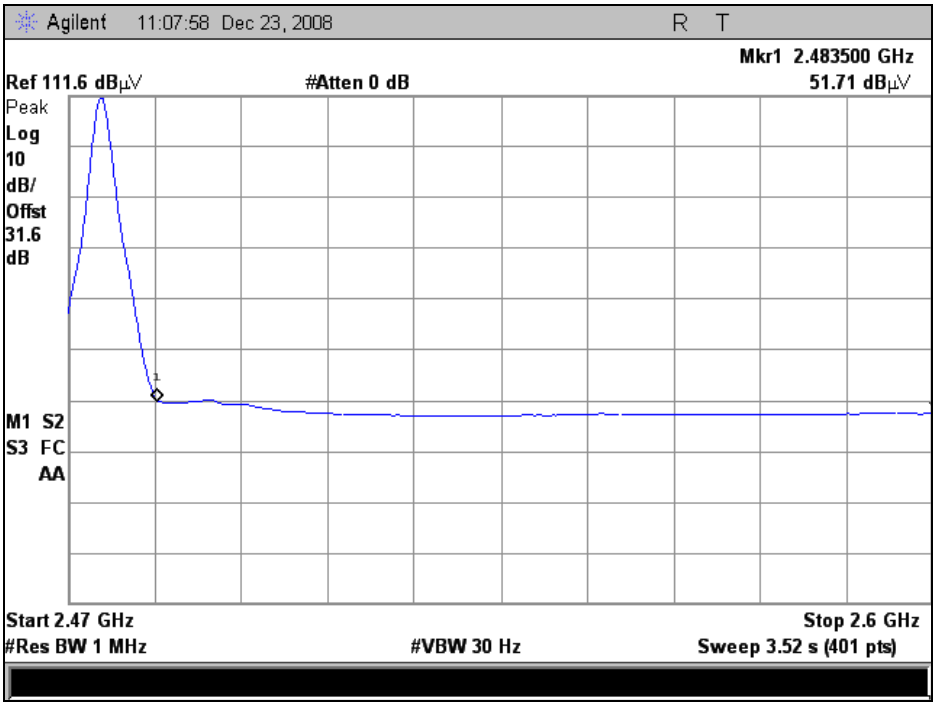



**Plot 17. Radiated Band Edge, Delta Measurement**

| Emission | Corrected Amplitude (dBuV) | Delta Method (dBuV) | Band Edge Measurement (dBuV) | Limit (dBuV) | Margin (dBuV) |
|---|---|---|---|---|---|
| Peak | 89.74 | 33.14 | 56.60 | 74 | 17.40 |
| Avg | 87.07 | 33.14 | 53.93 | 54 | 0.07 |



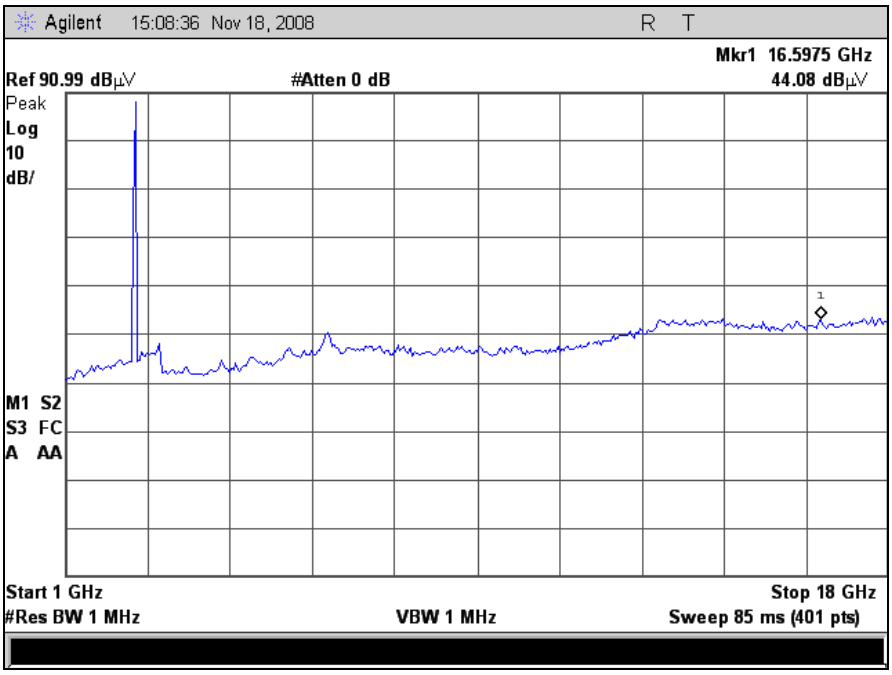

**Plot 18. Radiated Emissions, Band Edge, Second Highest Channel, Peak**



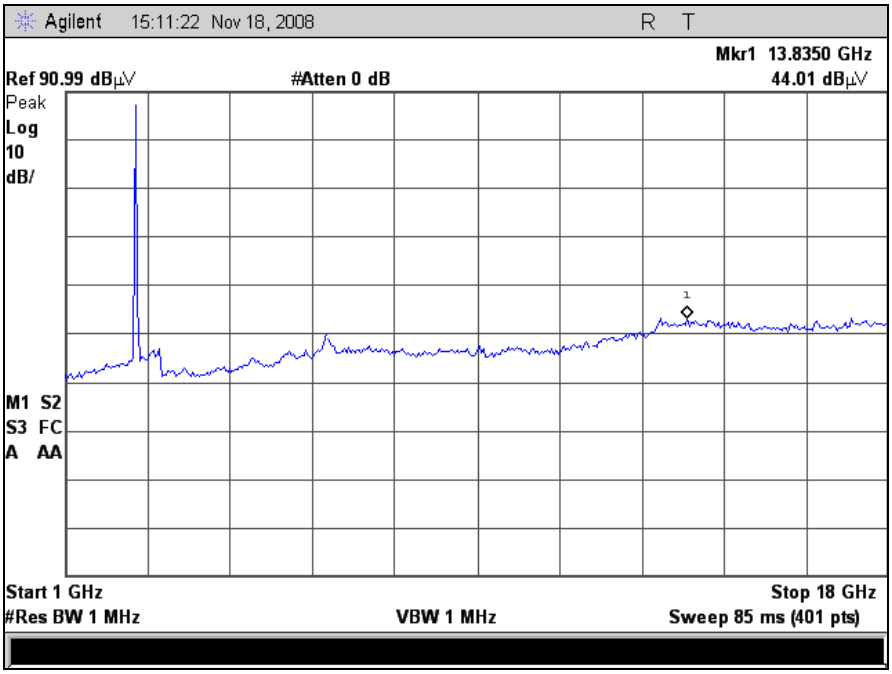

**Plot 19. Radiated Emissions, Band Edge, Second Highest Channel, Average**

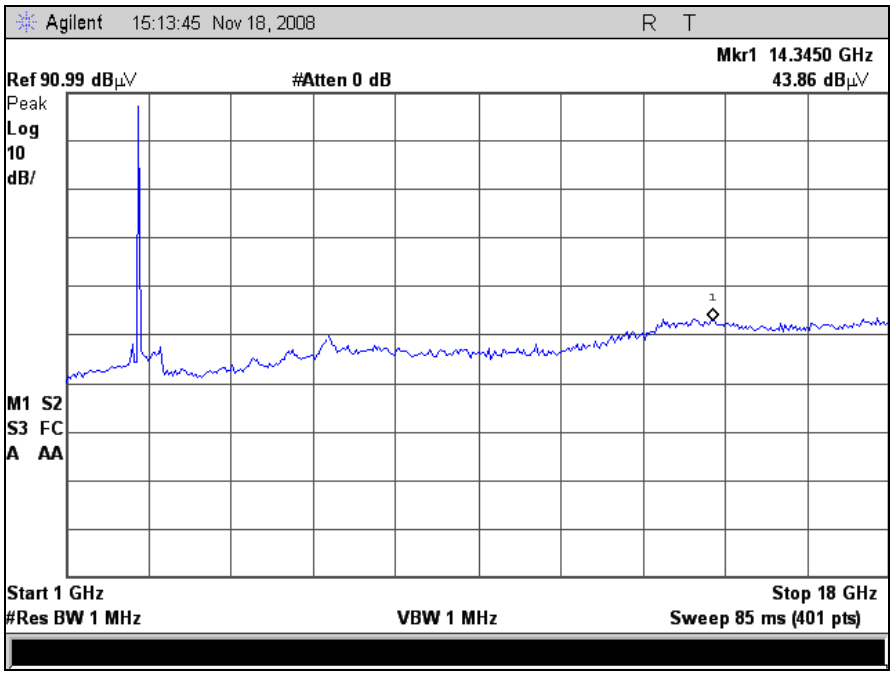
## Electromagnetic Compatibility Criteria for Intentional Radiators
## Radiated Spurious Emissions Plots




**Plot 20. Low Channel, Radiated Harmonic Emissions**




**Plot 21. Mid Channel, Radiated Harmonic Emissions**




**Plot 22. High Channel, Radiated Harmonic Emissions**

The EUT was investigated up to the 10th Harmonic of the carrier on the low, mid and high channels for Radiated Spurious, no peaks were found.

**Photograph 3. Test Equipment and setup for various Radiated Measurements**

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(d) Spurious Emissions Requirements – Conducted Spurious Emissions

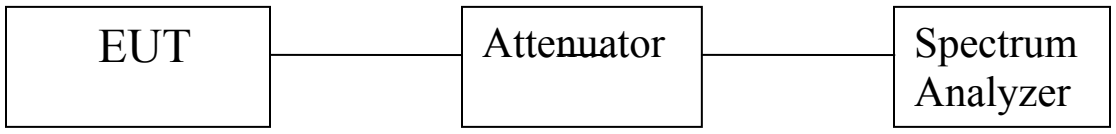
**Test Procedure:** For intentional radiators with a digital device portion which operates below 10 GHz, the spectrum was investigated as per §15.33(a)(1) and §15.33(a)(4); i.e., the lowest RF signal generated or used in the device up to the 10th harmonic of the highest fundamental frequency or to 40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

The EUT's antenna's port was connected to a spectrum analyzer using a 20dB attenuator. Conducted Spurious scans were measured on the low, mid and high channels starting at 30MHz up to the 10th Harmonic of the fundamental carrier.

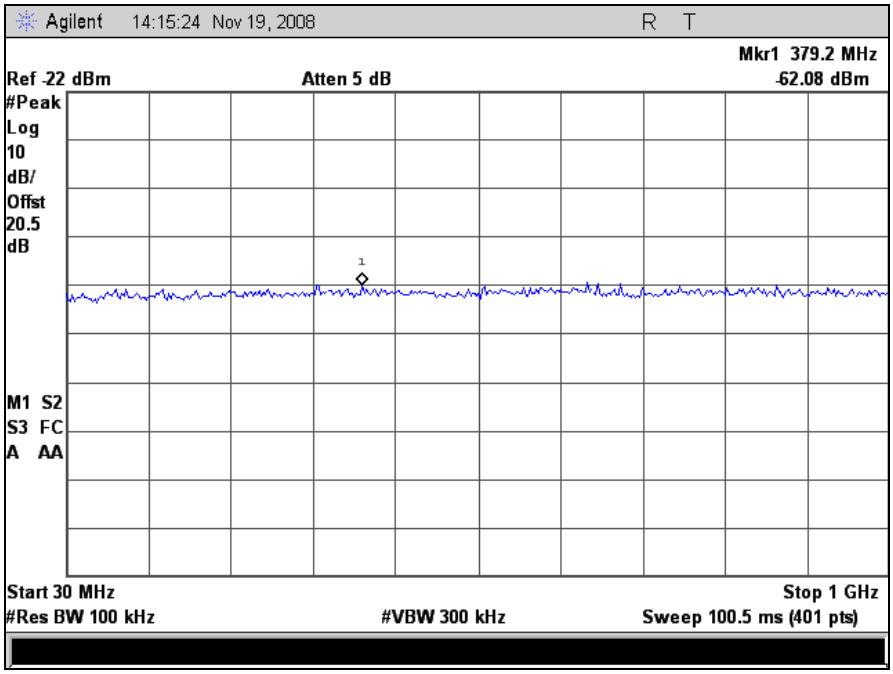
**Test Results:** Equipment complies with the Spurious Emissions Requirements – Conducted Spurious Emission limits of **§ 15.247 (d)**. For Radiated Emissions result, refer to section "§15.209: Radiated Emission Limits". See following pages for detailed test results with RF Conducted Spurious Emissions and §15.205.

**Test Engineer(s):** Edmund Cruz

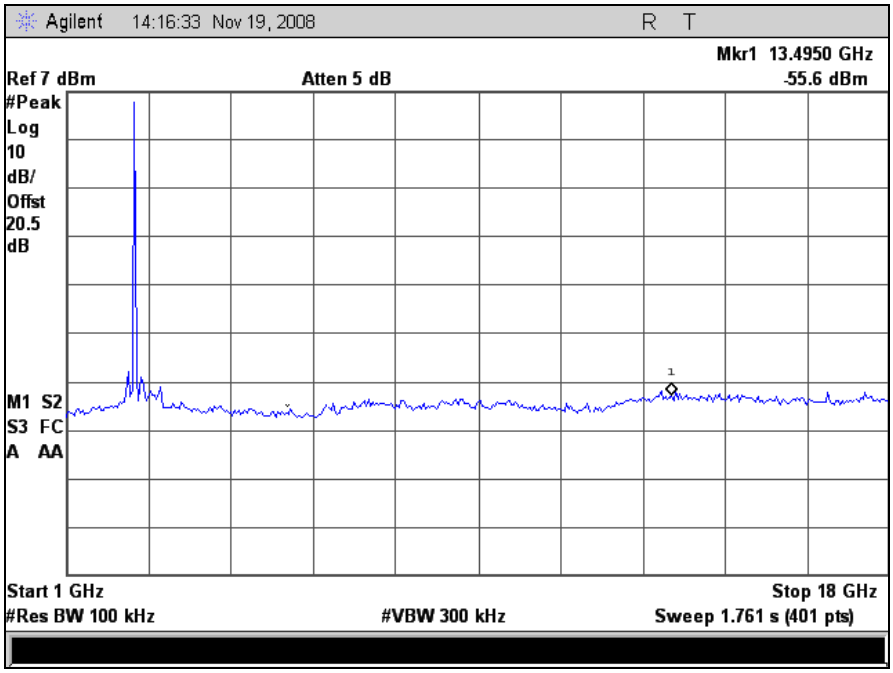
**Test Date(s):** 11/25/08




**Block Diagram 3. Spurious Conducted Emissions Test Setup**

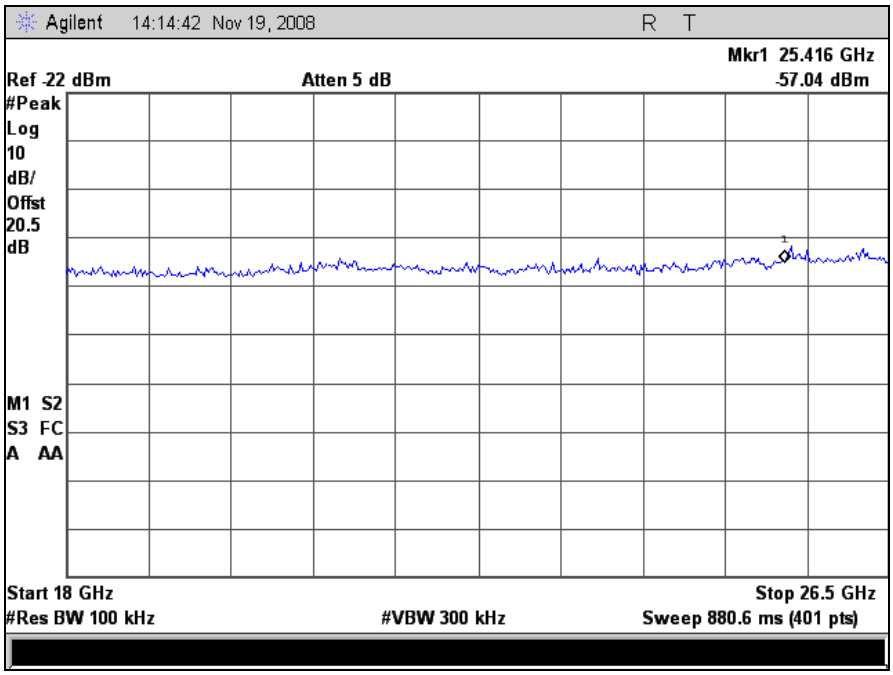



**Plot 23. Low Channel, Conducted Emissions, 30 MHz – 1 GHz**

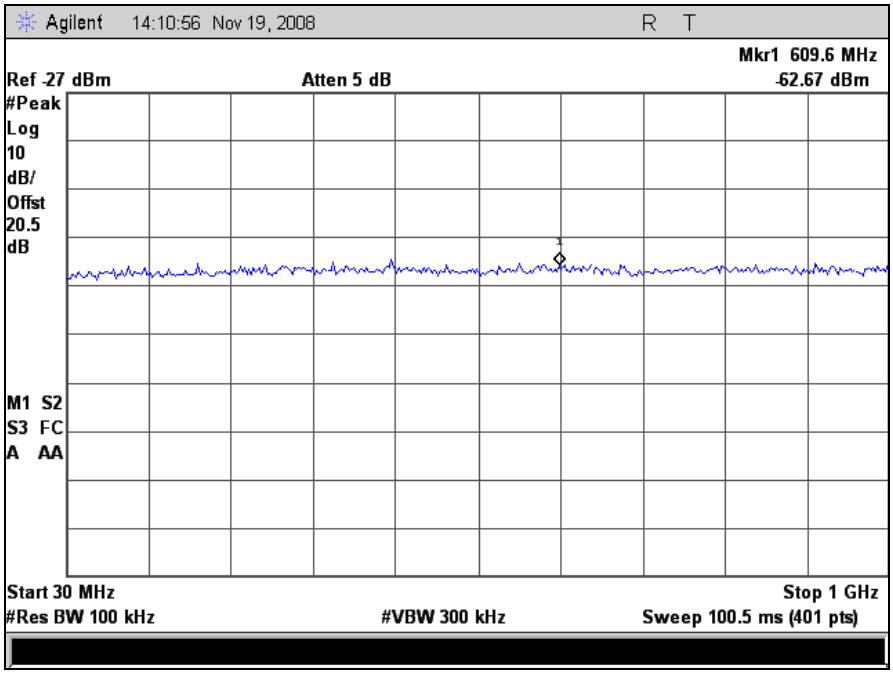



**Plot 24. Low Channel, Conducted Emissions, 1 – 18 GHz**

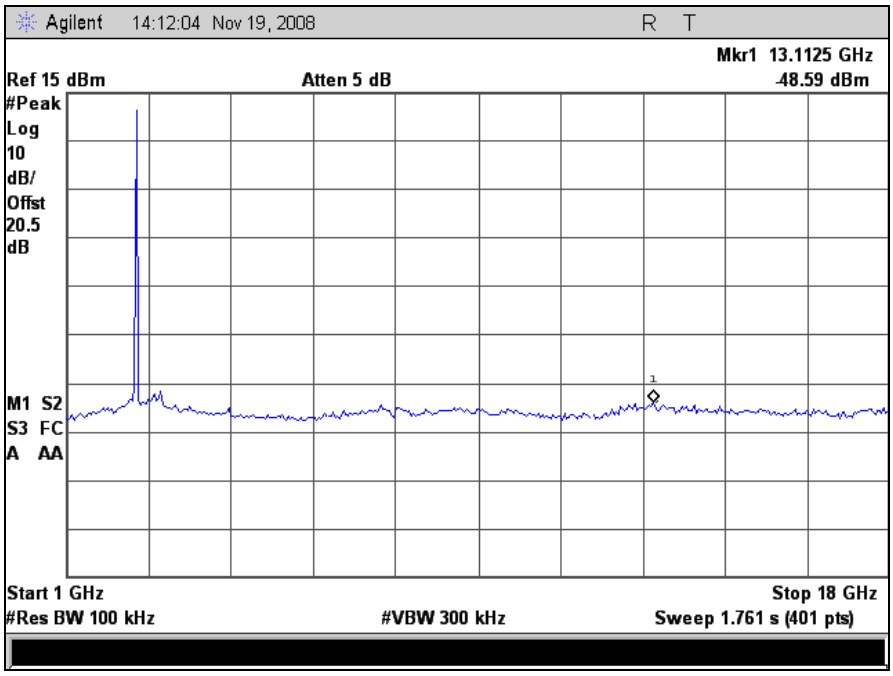



**Plot 25. Low Channel, Conducted Emissions, 18 – 26.5 GHz**

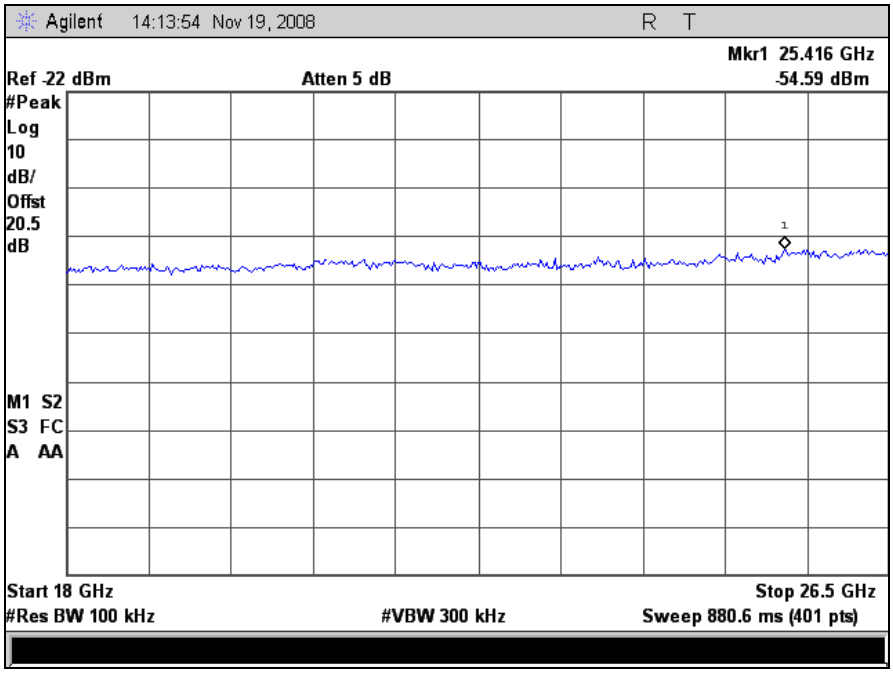



**Plot 26. Mid Channel, Conducted Emissions, 30 MHz – 1 GHz**

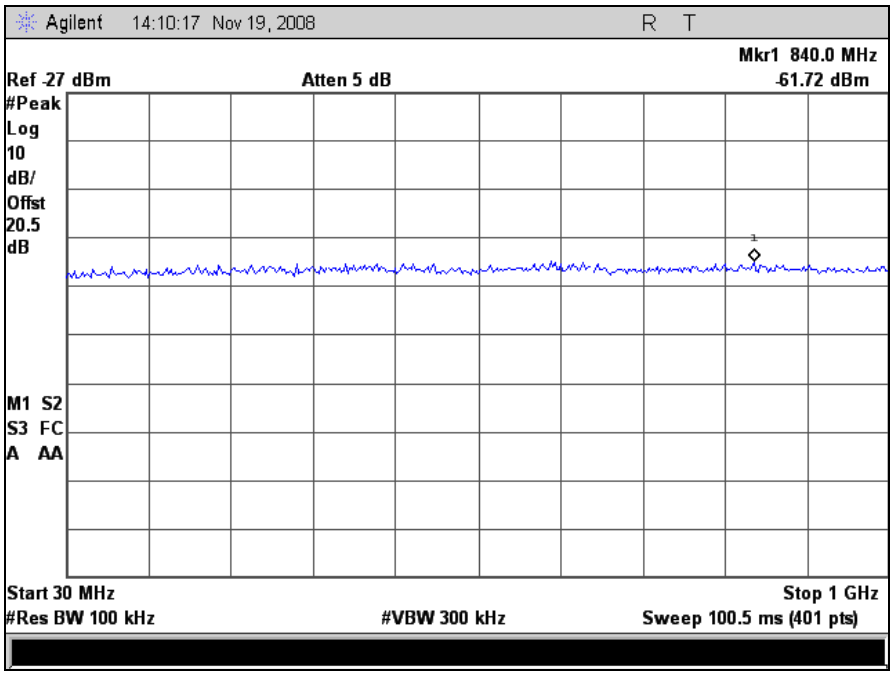
  



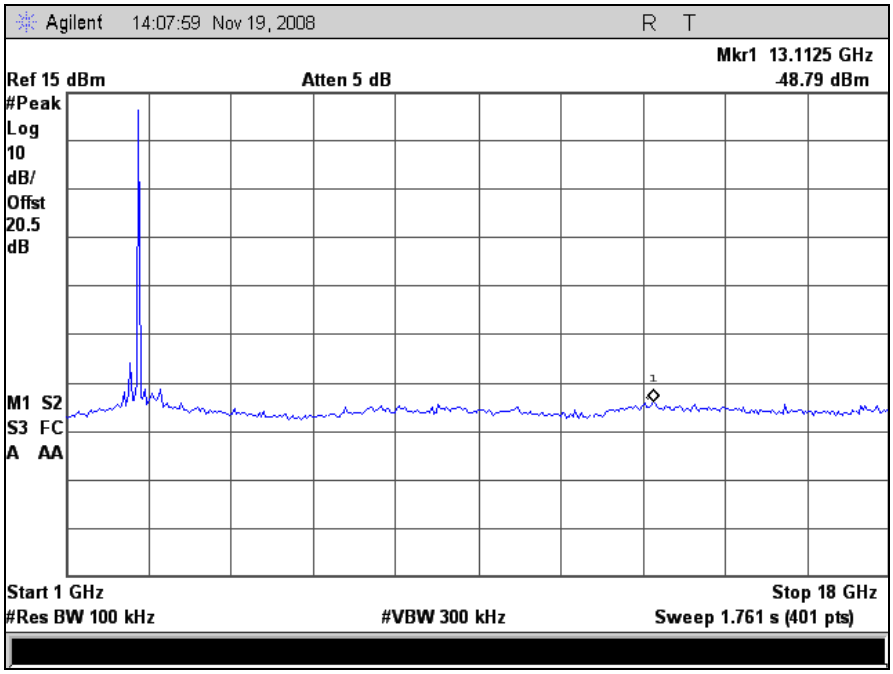

**Plot 27. Mid Channel, Conducted Emissions, 1 – 18 GHz**




**Plot 28. Mid Channel, Conducted Emissions, 18 – 26.5 GHz**

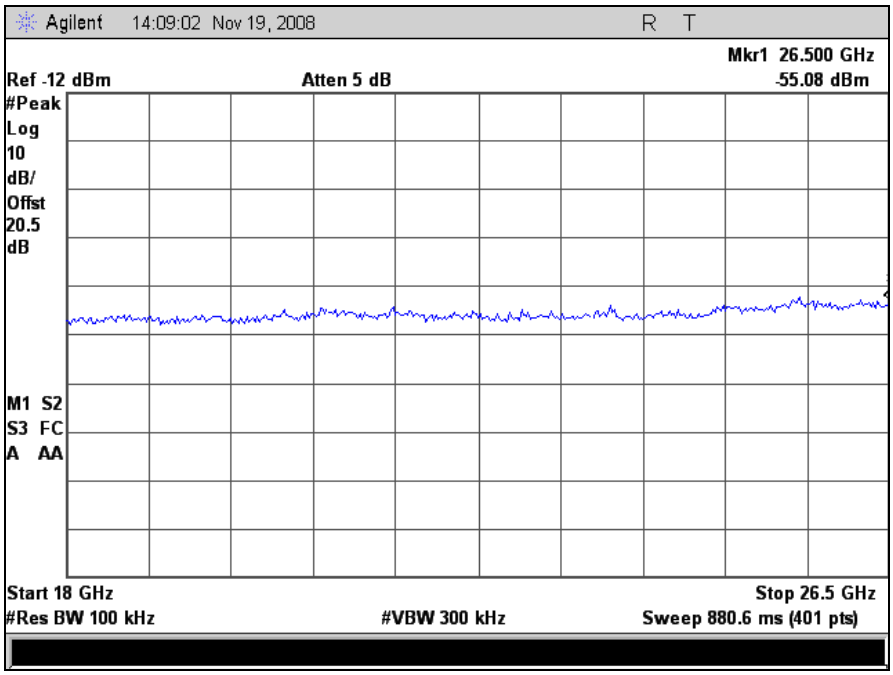



**Plot 29. High Channel, Conducted Emissions, 30 MHz – 1 GHz**




**Plot 30. High Channel, Conducted Emissions, 1 – 18 GHz**

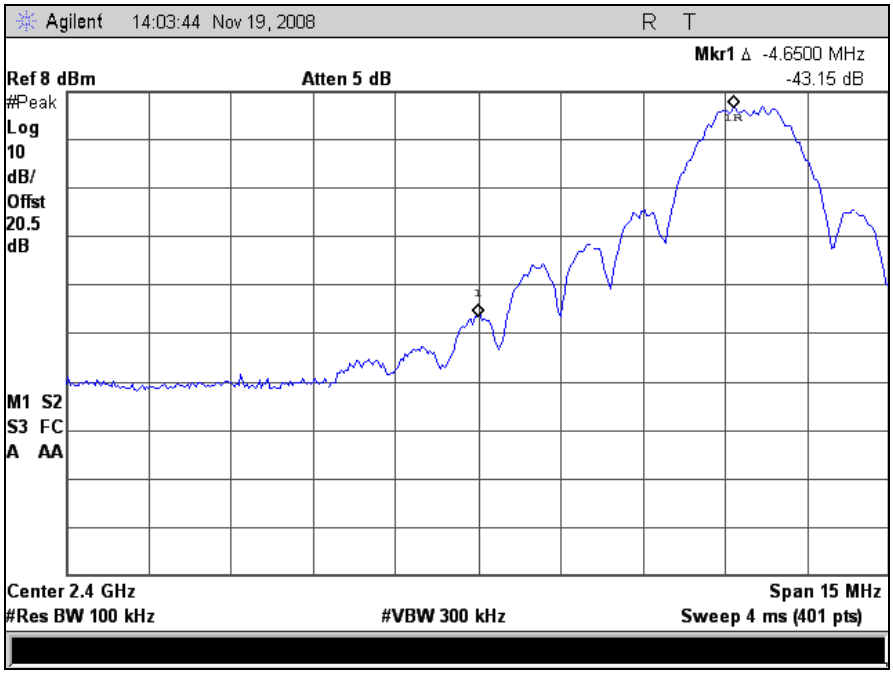
  



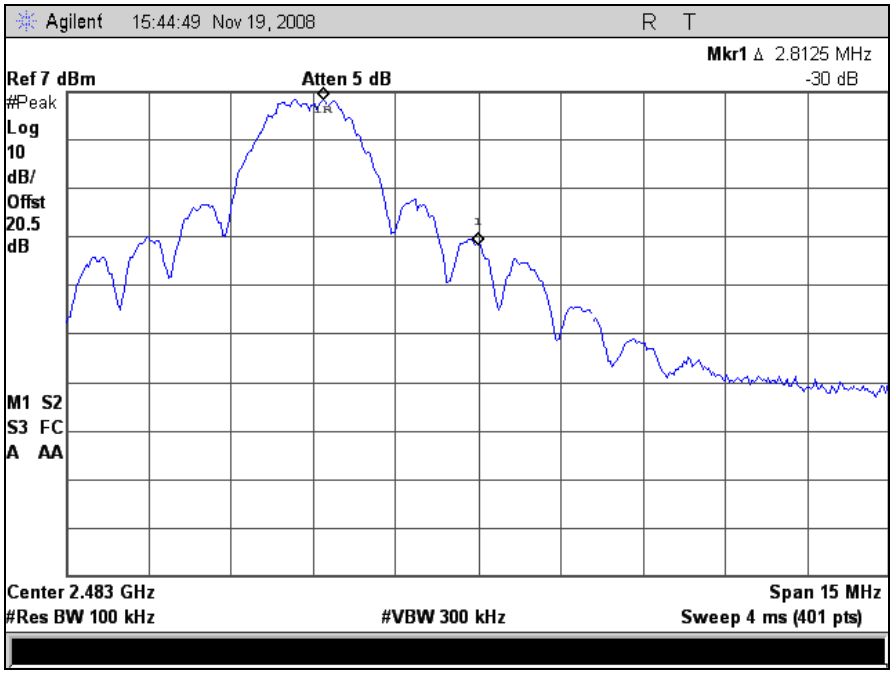

**Plot 31. High Channel, Conducted Emissions, 18 – 26.5 GHz**

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247 Spurious Emissions Requirements –Band Edge (Conducted)




**Plot 32. Lower Band Edge**




**Plot 33. Upper Band Edge**

## 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 was monitored at the coupler port with a Peak Power Meter. The power level was set to the maximum level. The RBW was set to 3 kHz with a VRB at 3*RBW. The spectrum analyzer was set to span 1MHz and sweep over a 333.3 second interval. Measurements were carried out at the low, mid and high channels.

**Test Results:** Equipment complies 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:** Edmund Cruz & Anderson Soungpanya

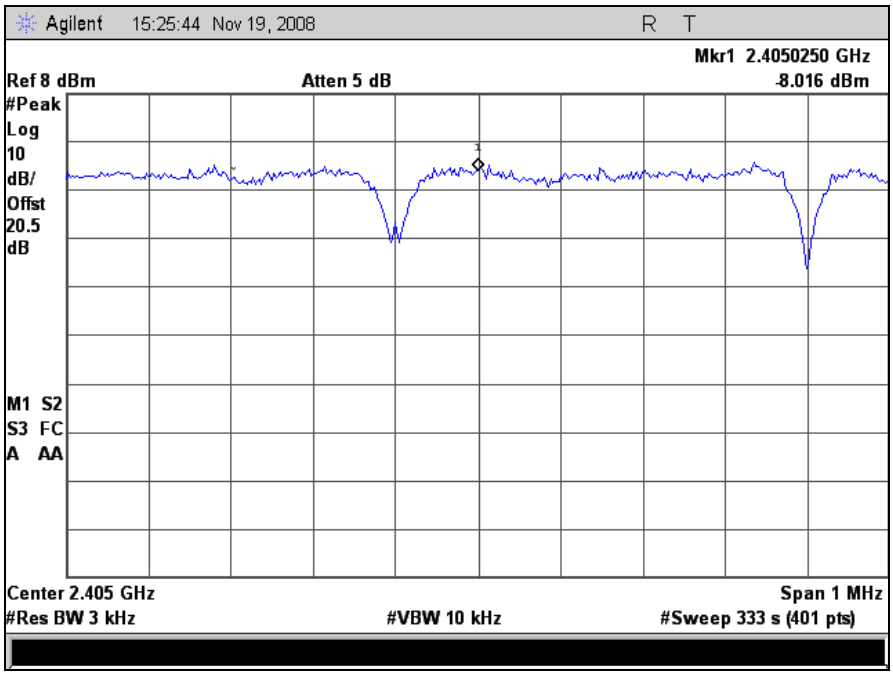
**Test Date:** 11/25/08 & 12/22/08

| 802.15.4 | | | | |
|---|---|---|---|---|
| **Carrier Channel** | **Frequency (MHz)** | **Measured PPSD (dBm)** | **Limit (dBm)** | **Margin (dB)** |
| Low | 2405 | -8.016 | 8 | 16.016 |
| Mid | 2440 | 1.044 | 8 | 6.956 |
| High | 2480 | -25.28 | 8 | 33.28 |

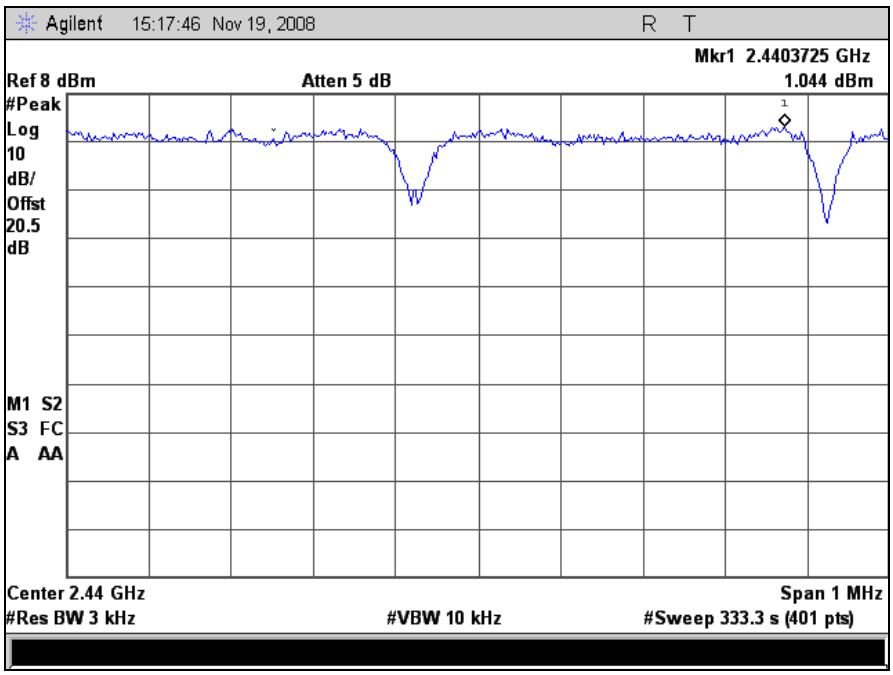
  

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(e) Peak Power Spectral Density (802.15.4)

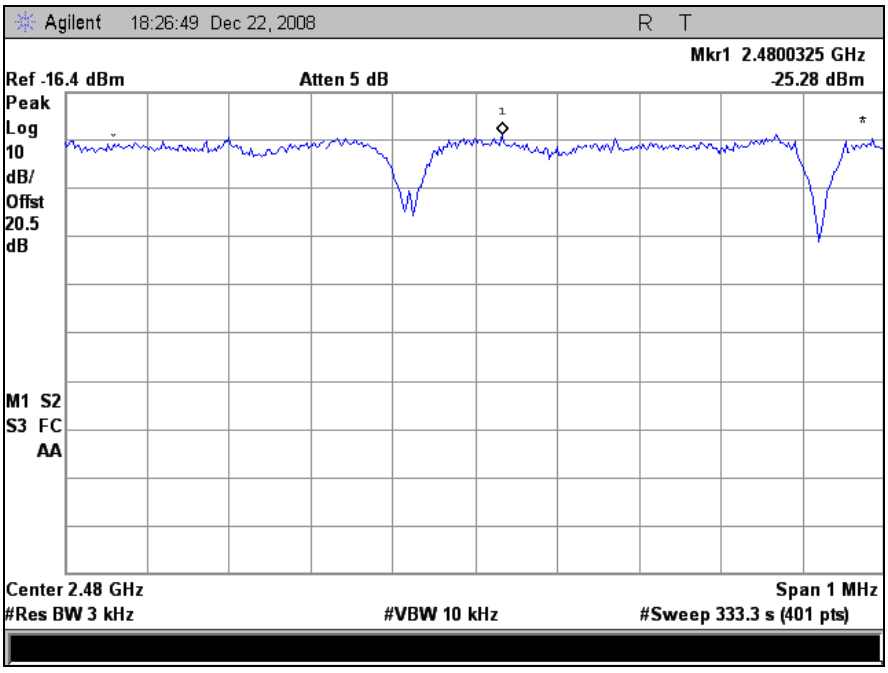



**Plot 34. Low Channel, Peak Power Spectral Density**

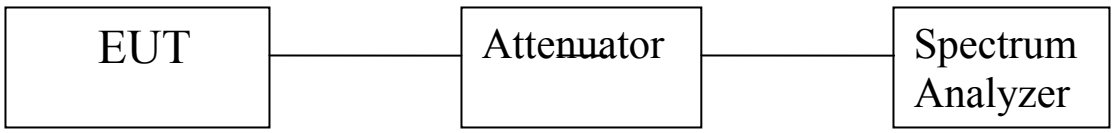



**Plot 35. Mid Channel, Peak Power Spectral Density**




**Plot 36. High Channel, Peak Power Spectral Density**




**Block Diagram 4. Peak Power Spectral Density Test Setup**

# IV. Test Equipment

## Test Equipment

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

| MET Asset # | Equipment | Manufacturer | Model | Last Cal Date | Cal Due Date |
|---|---|---|---|---|---|
| 1S2508 | AC LISN | SOLAR ELECTRONICS | TYPE 9252-50-R-24-BNC | 4/22/08 | 4/22/09 |
| 1S2438 | TRANSIENT LIMITER | AGILENT | 11947A | SEE NOTE | |
| 1S2460 | SPECTRUM ANALYZER | AGILENT | E4407B | 3/24/08 | 3/24/09 |
| 1S2198 | HORN ANTENNA | EMCO | 3115 | 9/10/08 | 9/10/09 |
| 1S2121 | PREAMP | HEWLETT PACKARD | 8449B | 10/26/08 | 10/26/09 |
| 1S2485 | BILOG ANTENNA | TESEQ | CBL-6112D | 1/21/08 | 1/21/09 |
| 1S2482 | 5M SEMI-ANECHOIC CHAMBER | PANASHIELD | N/A | 11/18/08 | 11/18/09 |
| N/A | HIGH PASS FILTER | MICRO-TRONICS | HPM13146 | SEE NOTE | |
| 1S2034 | COUPLER, DIRECTIONAL 1-20 GHZ | KRYTAR | 101020020 | SEE NOTE | |
| 1S2421 | EMI TEST RECEIVER | ROHDE & SCHWARZ | ESIB7 | 4/18/2008 | 4/18/2009 |
| 1S2484 | BILOG ANTENNA | TESEQ | CBL6112D | 1/21/08 | 1/21/09 |
| 1S2481 | 10M CHAMBER | ETS-LINDGREN | DKE 8X8 DBL | 12/26/2008 | 12/26/2009 |
| 1S2499 | MULTI DEVICE CONTROLLER | ETS | 2090 | N/A | N/A |
| 1S2501 | EMI RECEIVER | ESU40 | ROHDE SCHWARZ | 04-08-2008 | 04-08-2009 |
| 1S2488 | BILOG ANTENNA | N/A | TESEQ | 1/21/08 | 1/21/09 |

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

# V. Certification & User's Manual Information

# Certification & User's Manual Information

## A. Certification Information

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

**§ 2.801 Radio-frequency device defined.**

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

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

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

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

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

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

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

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

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

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

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

*(i) Compliance testing;*

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

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

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

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

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

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

## Certification & User's Manual Information

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

**§ 2.901 Basis and Purpose**

(a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service wherein the equipment is to be operated.[1] *In addition to the technical standards provided, the rules governing the service may require that such equipment be verified by the manufacturer or importer*, be authorized under a Declaration of Conformity, or receive an equipment authorization from the Commission by one of the following procedures: certification or registration.

(b) The following sections describe the verification procedure, the procedure for a Declaration of Conformity, and the procedures to be followed in obtaining certification from the Commission and the conditions attendant to such a grant.

**§ 2.907 Certification.**

(a) Certification is an equipment authorization issued by the Commission, based on representation and test data submitted by the applicant.

(b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

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

## Certification & User's Manual Information

### § 2.948 Description of measurement facilities.

(a) Each party making measurements of equipment that is subject to an equipment authorization under Part 15 or Part 18 of this chapter, regardless of whether the measurements are filed with the Commission or kept on file by the party responsible for compliance of equipment marketed within the U.S. or its possessions, shall compile a description of the measurement facilities employed.

(1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.

*(i) If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the Commission by that laboratory. In this situation, the party responsible for the verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.*

(ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.

(2) If the equipment is to be authorized by the Commission under the certification procedure, the description of the measurement facilities shall be filed with the Commission's Laboratory in Columbia, Maryland. The data describing the measurement facilities need only be filed once but must be updated as changes are made to the measurement facilities or as otherwise described in this section. At least every three years, the organization responsible for filing the data with the Commission shall certify that the data on file is current.

# Certification & User's Manual Information

## Label and User's Manual Information

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

**§ 15.19 Labeling requirements.**

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

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

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

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

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

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

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

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

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

**§ 15.21 Information to user.**

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

## Verification & User's Manual Information

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

**§ 15.105 Information to the user.**

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

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

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

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

– Reorient or relocate the receiving antenna.

– Increase the separation between the equipment and receiver.

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

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

## ICES-003 Procedural & Labeling Requirements

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

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

**Procedural Requirements:**

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

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

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

**Labeling Requirements:**

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

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

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

# End of Report