**MET Laboratories, Inc.** *Safety Certification - EMI - Telecom Environmental Simulation*
33439 WESTERN AVENUE ! UNION CITY, CALIFORNIA 94587 ! PHONE (510) 489-6300 ! FAX (510) 489-6372

January 18, 2007

Linak U.S.A.
2200 Stanley Gault Parkway
Louisville, KY 40223

Dear Pat Ferguson,

Enclosed is the EMC test report for compliance testing of the Linak U.S.A., MAHB0000M+2R0, tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-03 ed.), Part 15, Subpart C for Certification as a Periodic Intentional Radiator.

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.

Boonmanus Seelapasay
Documentation Department

Reference: (\Linak U.S.A.\ EMCS20284-FCC)

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

# Electromagnetic Compatibility Criteria
# Test Report

For the

**Linak U.S.A.**
**MAHB0000M+2R0**

Tested under
**The FCC Certification Rules Contained in Title 47 of the CFR, Part 15, Subpart C**
**For Certification as a Periodic Intentional Radiator**

**MET Report: EMCS20284-FCC**

January 18, 2007

**Prepared For:**

**Linak U.S.A.**
**2200 Stanley Gault Parkway**
**Louisville, KY 40223**

**Prepared By:**
**MET Laboratories, Inc.**
4855 Patrick Henry Drive, Building 6
Santa Clara, CA 95054

# Electromagnetic Compatibility Criteria
# Test Report

For the

## Linak U.S.A.
## MAHB0000M+2R0

Tested under

**The FCC Certification Rules Contained in Title 47 of the CFR, Part 15, Subpart C**
**For Certification as a Periodic Intentional Radiator**

## MET Report: EMCS20284-FCC

Shawn McMillen
Electromagnetic Compatibility Lab

Boonmanus Seelapasay
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 Title 47 of the CFR, Part 15, Subpart C for Certification as a Periodic Intentional Radiator and Part 15, Subpart B for a Class A Unintentional Radiator under normal use and maintenance.

Tony Permsombut, Manager
Electromagnetic Compatibility Lab

# Report Status Sheet

| Revision | Report Date | Reason for Revision |
|---|---|---|
| & | January 18, 2007 | Initial Issue. |

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# List of Terms and Abbreviations

| | |
|---|---|
| **AC** | **A**lternating **C**urrent |
| **ACF** | **A**ntenna **C**orrection **F**actor |
| **Cal** | **Cal**ibration |
| **d** | **M**easurement **D**istance |
| **dB** | **D**eci **B**els |
| **dBΦV** | **D**eci-**B**els above one **micro V**olt |
| **dBΦV/m** | **D**eci-**B**els above one **micro V**olt **per m**eter |
| **DC** | **D**irect **C**urrent |
| **DCF** | **D**istance **C**orrection **F**actor |
| **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 |
| **H** | Magnetic Field |
| **GHz** | **G**iga **H**ertz |
| **Hz** | **H**ertz |
| **ICES** | **I**nterference-**C**ausing **E**quipment **S**tandard |
| **kHz** | **k**ilo**h**ertz |
| **kPa** | **k**ilo**pa**scal |
| **kV** | **k**ilo **V**olt |
| **LISN** | **L**ine **I**mpedance **S**tabilization **N**etwork |
| **MHz** | **M**ega**H**ertz |
| **ΦH** | **micro H**enry |
| **ΦF** | **micro F**arad |
| **Φs** | **micro s**econds |
| **RF** | **R**adio **F**requency |
| **RMS** | **R**oot-**M**ean-**S**quare |

# I. Executive Summary

## A. Purpose of Test

An EMC evaluation to determine compliance of the Linak U.S.A., MAHB0000M+2RD, with the requirements of Part 15, Subpart C, §15.231 was performed. 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 Linak U.S.A., MAHB0000M+2RD. Linak U.S.A. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Linak U.S.A., MAHB0000M+2RD 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, Subpart C, §15.231, in accordance with Linak U.S.A, purchase order number 3501. All tests were conducted using measurement procedure ANSI C63.4-2003.

| Reference | Description | Results |
|---|---|---|
| 15.107 | AC Power Line Conducted Emissions | Not Applicable |
| 15.109 | Radiated Emissions | Compliant |
| 15.203 | Antenna Requirements | Compliant |
| 15.207 | AC Conducted Emissions | Not Applicable |
| 15.231 (b)(3) / 15.209 | Spurious Radiated Emissions | Compliant |
| 15.231 (b)(2) / 15.205 | Spurious Radiated Emission | Compliant |
| 15.231 (a)(1) & (a)(2) | Required measurement for manually and automatic operated transmitter equipment. <5 Sec. after activation | Compliant |
| 15.231 (b)(1) | Radiated Emission | Compliant |
| 15.231 (a3) | Transmission at predetermined/regular intervals are not permitted | Not Applicable |
| 15.231 (c) | Devices operated within the frequency band of 70 – 900MHz: -20dBc Bandwidth maximum of 0.25% of the center frequency | Compliant |
| 15.231 (d) | Frequency Stability | Not Applicable |

**Table 1. Summary of Test Results**

# II. Equipment Configuration

# A. Overview

MET Laboratories, Inc. was contracted by Linak U.S.A. to perform testing on the MAHB0000M+2R0, under Linak U.S.A. purchase order number 3501.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Linak U.S.A., MAHB0000M+2R0.

In accordance with §2.955(a) (3), the following data is presented in support of the verification of the Linak U.S.A., MAHB0000M+2R0. Linak U.S.A. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the MAHB0000M+2R0 has been **permanently** discontinued, as per §2.955(b).

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

| | |
|---|---|
| **Model(s) Tested:** | MAHB0000M+2R0 |
| **Model(s) Covered:** | MAHB0000M+2R0 |
| **EUT Specifications:** | Primary Power: 3 AAA Batteries |
| | Secondary Power: N/A |
| | Equipment Emissions Class: B |
| | Highest Clock Frequency: 4 MHz |
| **Evaluated by:** | Shawn McMillen |
| **Date(s):** | January 18, 2007 |

## 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 |
| **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 |

## C. Test Site

All testing was performed at MET Laboratories, Inc., 4855 Patrick Henry Drive, Building 6, Santa Clara, CA 95054. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a semi-anechoic chamber. In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories. In accordance with §2.948(d), MET Laboratories has been accredited by the National Voluntary Laboratory Accreditation Program (Lab Code: 100273-0).

## D. Description of Test Sample

The MAHB0000M+2R0, Equipment Under Test (EUT) for the remainder of this document, is a Handheld Portable 315 MHZ ASK transmitter operating at 1200 Baud intended to send a simple digital stream indicating which of up to 16 buttons are pressed.

Different models will have different number of buttons and different printing; pcb will remain the same for all models regardless of number of buttons.

There is al so a selector switch at the top of the unit, which simply changes a source id in the message string (Therefore functions as a virtual channel selector, even though the modulation frequency is not changed).

## E. Equipment Configuration

The EUT was set up as outlined in Figure 1. All equipment incorporated as part of the EUT is included in the following list.

| Ref. ID | Slot # | Name / Description | Model Number | Part Number | Serial Number | Rev. # |
|---|---|---|---|---|---|---|
| A | N/A | MAHB Wireless Transmitter | MAHB | 0000M+1R0 | N/A | N/A |
| B | N/A | MAHB Wireless Transmitter | MAHB | 0000M+1R0 | N/A | N/A |

**Table 2. Equipment Configuration**

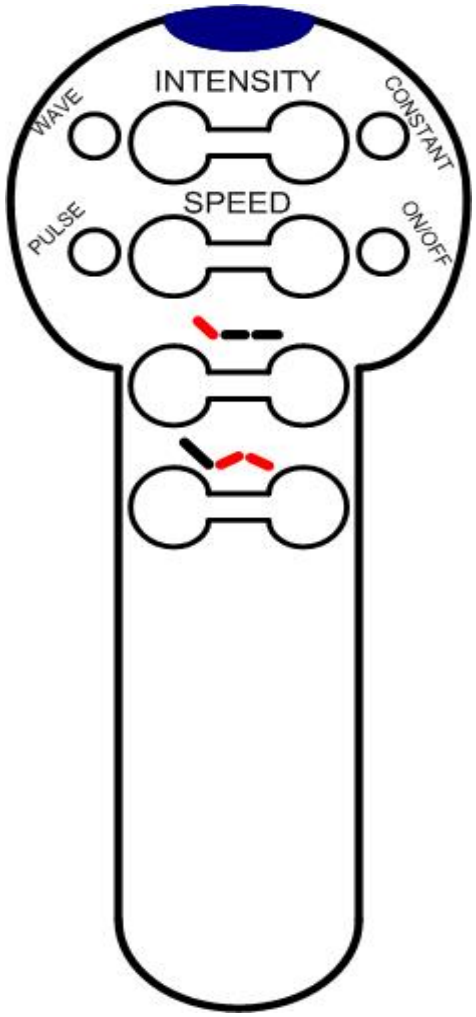



**Figure 1. Block Diagram of Test Configuration**

## F. Mode of Operation

There are only two modes of operation total:

One transmitting where you would have a 4 MHZ clock internal to the microprocessor running in addition to the internal transmitter, the other when no button is pressed and the microprocessor goes into sleep mode and no RF transmission is present whatsoever.

We can provide a hi tech means of automatic activation, such as a roll of duct tape and a marble, that can be used to hold a button down and place the transmitter in continuous activation mode.

## G. Method of Monitoring EUT Operation

A blue LED at the top center of the controller will flash when data is being transmitted, and will be off when data is not being transmitted.

## H. 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.

## I. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Linak U.S.A. upon completion of testing.

# III. Electromagnetic Compatibility Criteria for Unintentional Radiators

# Electromagnetic Compatibility Intentional Radiators

## § 15.109(a)(b) 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 3.

**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 3.

| 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 3. 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 10m 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 Compliant with the Class B requirement(s) of this section. Measured emissions were below applicable limits.

**Test Engineer(s):**

Billy Kwan

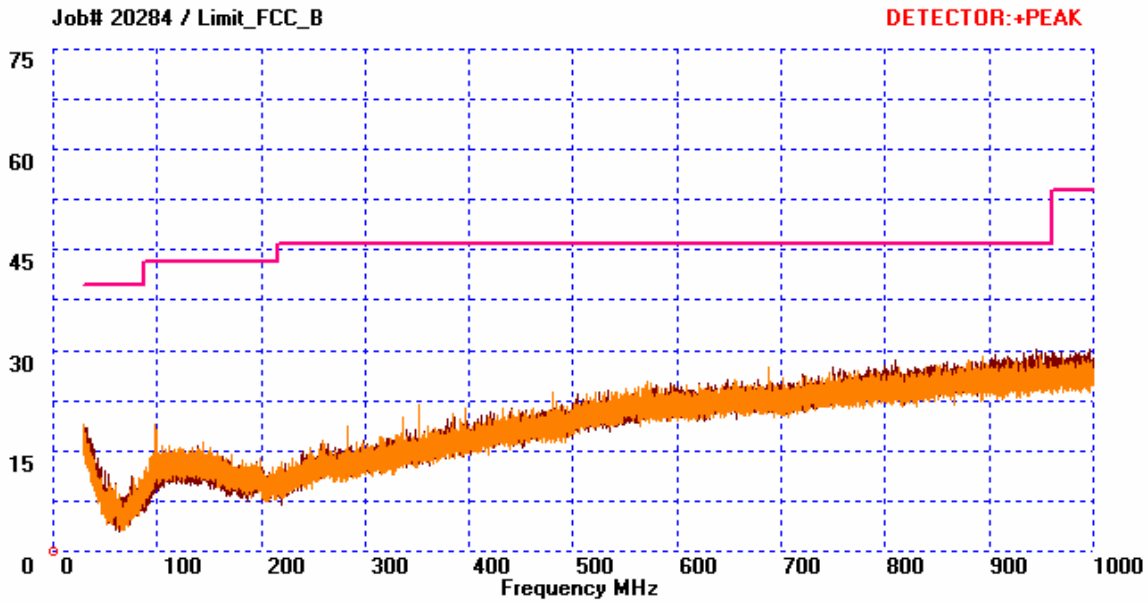
**Test Date(s):**

12/20/2006

## Radiated Emissions Limits Test Results, 30 MHz - 1 GHz, Class B

| Frequency (MHz) | Antenna Polarity (H/V) | EUT Azimuth (Degrees) | Antenna Height (m) | Uncorrected Amplitude QP Detector (dBuv) | Antenna Correction Factor (dB/m) (+) | Cable Loss (dB) (+) | Corrected Amplitude (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 97.72 | V | 215 | 1.00 | 4.86 | 11.54 | 1.70 | 18.11 | 43.50 | -25.40 |
| 100.28 | V | 172 | 1.13 | 3.32 | 12.04 | 1.74 | 17.10 | 43.50 | -26.40 |
| 283.48 | V | 273 | 1.00 | 5.63 | 13.04 | 2.82 | 21.49 | 46.00 | -24.51 |
| 336.08 | V | 77 | 1.00 | 4.12 | 14.50 | 3.13 | 21.75 | 46.00 | -24.25 |
| 352.00 | V | 161 | 1.00 | 6.92 | 14.84 | 3.21 | 24.97 | 46.00 | -21.03 |
| 681.92 | V | 0 | 1.00 | -3.98 | 19.98 | 4.91 | 20.91 | 46.00 | -25.09 |

**Table 4. Radiated Emissions Limits Test Results**




**Radiated Emissions Limits Test Results**

## Radiated Emission Limits Test Setup

**Photograph 1. Radiated Emission Limits Test Setup**

# IV. Electromagnetic Compatibility Criteria for Intentional Radiators

## Electromagnetic Compatibility Unintentional 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 having a permanently attached internal antenna soldered onto the EUT and is not accessible by the user. The EUT is therefore compliant with §15.203.

Type of Antenna: Antenna is permanently soldered on EUT

**Test Engineer(s):** Shawn McMillen

**Test Date(s):** 12/20/2006

# Electromagnetic Compatibility Criteria for Intentional Radiators

## § 15.231(a) Radiated Emissions Limits

**Test Requirement(s):** **15.205 (a)** The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in **Table 3**. The Restricted Band limits for this EUT are listed in Table 6.

**15.209 (a)** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in Table 3. The Carrier Emissions limits for this EUT are listed in Table 6.

Radiated Emissions above 960 MHz from a device operating under this section shall not exceed the following average limits when measured using a RBW of 1 MHz.

| Frequency (MHz) | EIRP (dBm) |
|---|---|
| 960 - 1610 | -53.3 |
| 1610 - 1990 | -51.3 |
| 1990 - 10600 | -41.3 |
| Above 10600 | -51.3 |

**Table 5. Limits for Radiated Emissions, Average Broadband (High - RBW = 1MHz)**

**15.231 (a)** The provisions of this section are restricted to periodic operation within the band 40.66–40.70 MHz and above 70 MHz. Except as shown in paragraph (e)* of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote based on measurement instrumentation employing an average detector. Provisions made in 15.35 for limiting switches, etc. Radio control of toys is not permitted. Continuous transmissions, such as voice or video, and data transmissions are not permitted.

*Note: Intentional radiators may operate at a periodic rate exceeding that specified in 15.231 (a) must meet the limits expressed in 15.231(e).

**15.231 (b)** In addition to the provisions of 15.205 Restricted bands of operation, the field strength of emissions from intentional radiators operated under this section shall not exceed the limits specified in 15.231(b). Restricted Band limits for this EUT are listed in Table 6.

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

Devices operated under the provisions of *15.231(e)* shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

| | |
|---|---|
| **Carrier Emissions Limit:** | 260 - 470 MHZ : 3750 to 12500 :V/m (linearly interpolated) = 4543.2 :V/m = 73.15 dBuV @ 3m |
| **Duty Cycle Duration:** | Pulse train =$TX_{ON}$ + $TX_{OFF}$ = 11.995ms + 23.444ms = 35.440ms<br>*FCC Part 15.35(c) : for pulse trains > 0.1 sec., use 0.1 sec*<br>Duty Cycle Correction = 20 Log (11.995ms/35.440ms) = -9.41 dB |
| **Spurious Emission Limits:** | @ 3m with carrier = 315 MHz:454.3 :V/m = 53.14 dBuV |
| **Restricted Band Limits:** | Limit = 20 Log (500uv/m) = 53.97 dB @ 3m |

**Table 6. Radiated Emissions limits from Sections 15.205(a), 15.209(a), and 15.231(b).**

**Test Procedure:**

The transmitter was set to the mid channel 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. Measurement were repeated the measurement at the low and highest channels.

For frequencies from 30 MHz to 1 GHz, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

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.

In accordance with §15.35(b) the limit on the radio frequency emissions as measured using instrumentation with a peak detector function shall be 20 dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules.

EUT Field Strength Final Amplitude = Raw Amplitude – Preamp gain + Antenna Factor + Cable Loss – Distance Correction Factor (1 meter)

| 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 6. Restricted Bands of Operation**

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

[2] Above 38.6

**Test Results:** The EUT was found compliant with the Radiated Emission limits of **§15.231(a)** for Intentional Radiators. See following pages for detailed test results.

**Test Engineer(s):** Billy Kwan

**Test Date(s):** 12/20/2006

## Periodic Intentional Radiator, Sections 15.205(a), 15.209(a) 15.231(b) Fundamental Radiated Emissions Test Results

| | Frequency (MHz) | Antenna Polarity (H/V) | EUT Azimuth (Degrees) | Antenna Height (m) | Uncorrected Amplitude Detector (dBuv) | Amplitude corrected with Duty Cycle factor (dBuv) | Antenna Correction Factor0020 (dB/m) (+) | Cable Loss (dB) (+) | Corrected Amplitude (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Peak | 315 | H | 267 | 1 | 40.69 | 13.77 | 14.25 | 3.01 | 31.03 | 93.15 | -62.12 |
| Average | 315 | H | 267 | 1 | 32.24 | 10.91 | 14.25 | 3.01 | 28.17 | 73.15 | -44.98 |

**Table 7. Fundamental Radiated Emissions Test Results**

## Periodic Intentional Radiator, Sections 15.205(a), 15.209(a) 15.231(b) Spurious Radiated Emissions, Below 1 GHz Test Results

| | Frequency (MHz) | Antenna Polarity (H/V) | EUT Azimuth (Degrees) | Antenna Height (m) | Uncorrected Amplitude QP Detector (dBuv) | Antenna Correction Factor (dB/m) (+) | Cable Loss (dB) (+) | Corrected Amplitude (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| Peak | 630 | H | 62 | 1.35 | 33.92 | 19.80 | 4.72 | 58.44 | 73.14 | -14.7 |
| Average | 630 | H | 62 | 1.35 | 25.31 | 19.80 | 4.72 | 49.83 | 53.14 | -3.31 |
| Peak | 945* | H | 84 | 1.00 | 21.91 | 22.30 | 6.13 | 50.34 | 74.00 | -23.66 |
| Average | 945* | H | 84 | 1.00 | 14.08 | 22.30 | 6.13 | 42.51 | 54.00 | -11.49 |

**Table 8. Spurious Radiated Emissions, Below 1 GHz, Test Results**

Note(s): The EUT was tested at 3 m.
***** Frequency falls within the restricted band.

## Periodic Intentional Radiator, Sections 15.205(a), 15.209(a) 15.231(b) Spurious Radiated Emissions, Above 1 GHz Test Results

| | Frequency (MHz) | Antenna Polarity (H/V) | EUT Azimuth (Degrees) | Antenna Height (m) | Uncorrected Amplitude QP Detector (dBuv) | Antenna Correction Factor (dB/m) (+) | Pre Amp Gain (dB) (-) | Cable Loss (dB) (+) | Corrected Amplitude (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Peak | 1260 | H | 136 | 2.22 | 51.76 | 24.98 | 35.23 | 2.32 | 43.82 | 73.14 | -29.32 |
| Average | 1260 | H | 136 | 2.22 | 43.21 | 24.98 | 35.23 | 2.32 | 35.27 | 53.14 | -17.87 |
| Peak | 1575* | H | 90 | 1.66 | 51.06 | 25.98 | 35.15 | 2.64 | 44.53 | 74.00 | -29.47 |
| Average | 1575* | H | 90 | 1.66 | 42.51 | 25.98 | 35.15 | 2.64 | 35.98 | 54.00 | -18.02 |
| Peak | 1889 | H | 153 | 1.72 | 43.61 | 27.38 | 35.17 | 3.11 | 38.93 | 73.14 | -34.21 |
| Average | 1889 | H | 153 | 1.72 | 26.87 | 27.38 | 35.17 | 3.11 | 22.18 | 53.14 | -30.96 |
| Peak | 2205 | H | 151 | 1.75 | 51.56 | 28.32 | 35.18 | 3.45 | 48.15 | 74.00 | -25.85 |
| Average | 2205 | H | 151 | 1.75 | 42.81 | 28.32 | 35.18 | 3.45 | 39.40 | 54.00 | -14.60 |
| Peak | 2519 | H | 359 | 1.14 | 51.87 | 29.06 | 35.28 | 3.70 | 49.35 | 73.14 | -23.79 |
| Average | 2519 | H | 359 | 1.14 | 39.07 | 29.06 | 35.28 | 3.70 | 36.55 | 53.14 | -16.59 |
| Peak | 2835* | H | 209 | 1.79 | 45.78 | 30.31 | 35.46 | 3.93 | 44.56 | 74.00 | -29.44 |
| Average | 2835* | H | 209 | 1.79 | 36.17 | 30.31 | 35.46 | 3.93 | 34.95 | 54.00 | -19.05 |
| Peak | 3150 | H | 152 | 1.35 | 54.97 | 31.29 | 35.53 | 4.15 | 54.88 | 73.14 | -18.26 |
| Average | 3150 | H | 152 | 1.35 | 45.41 | 31.29 | 35.53 | 4.15 | 45.32 | 53.14 | -07.82 |

**Table 9. Spurious Radiated Emissions, Above 1 GHz, Test Results**

Note(s): The EUT was tested at 3 m.
* Frequency falls within the restricted band.

# Electromagnetic Compatibility Criteria for Intentional Radiators

**Photograph 2: Radiated Emission Test Setup < 1 GHz**

# Electromagnetic Compatibility Criteria for Intentional Radiators

**Photograph 3: Radiated Emission Test Setup > 1 GHz**

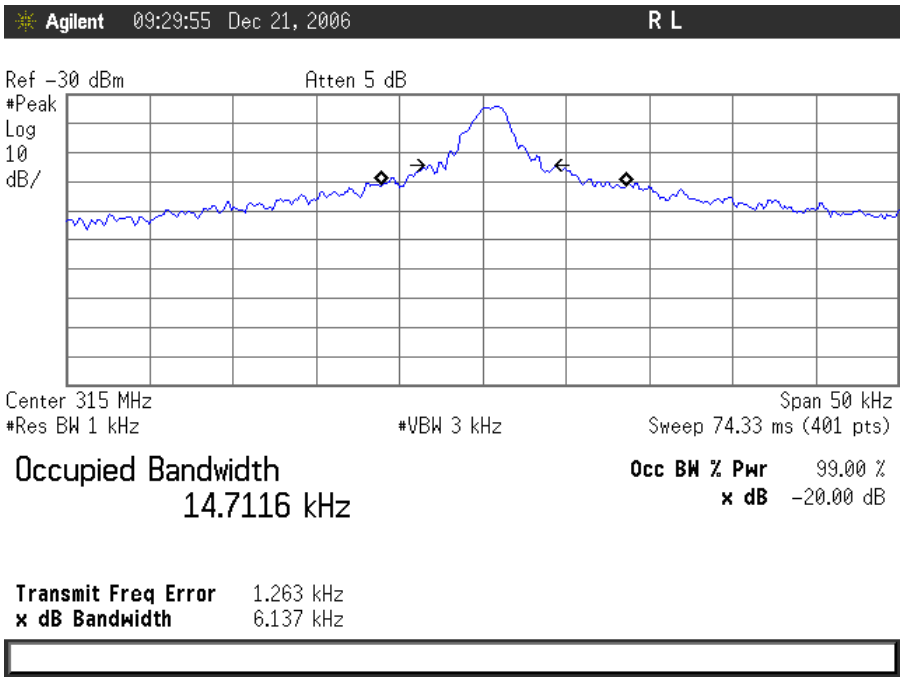
## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.231(c) 20dB Bandwidth

**Test Requirements:** **§15.231(c):** The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. For devices operating above 900MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20dB down from the modulated carrier. Operation under the provisions of this section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

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

| Carrier Frequency (MHz) | Measured 20 dB Bandwidth (kHz) |
|---|---|
| 315 | 6.137 |



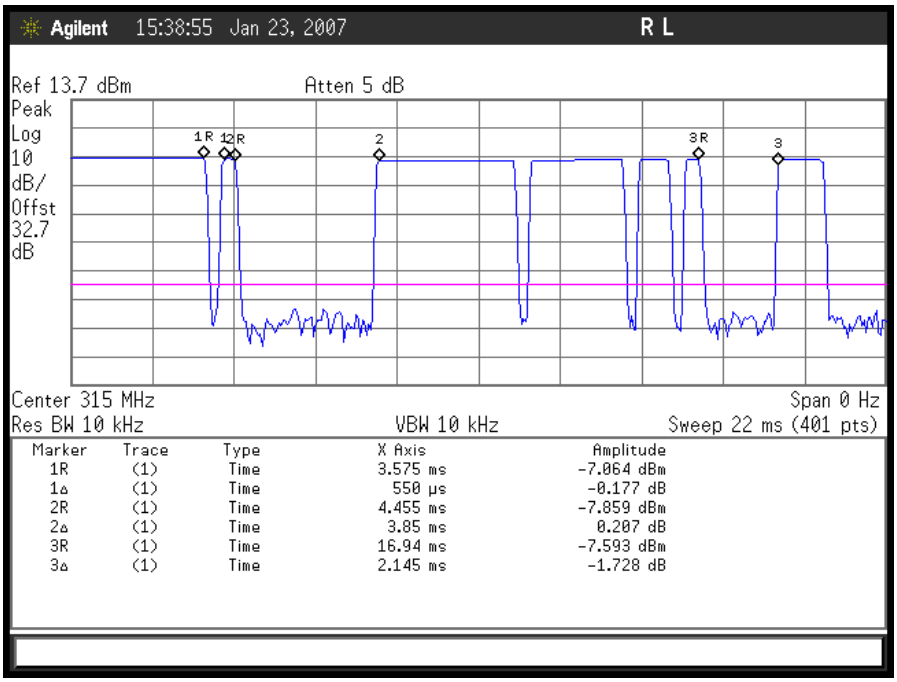

**Test Engineer:** Shawn McMillen

**Test Date:** 09/20/2005

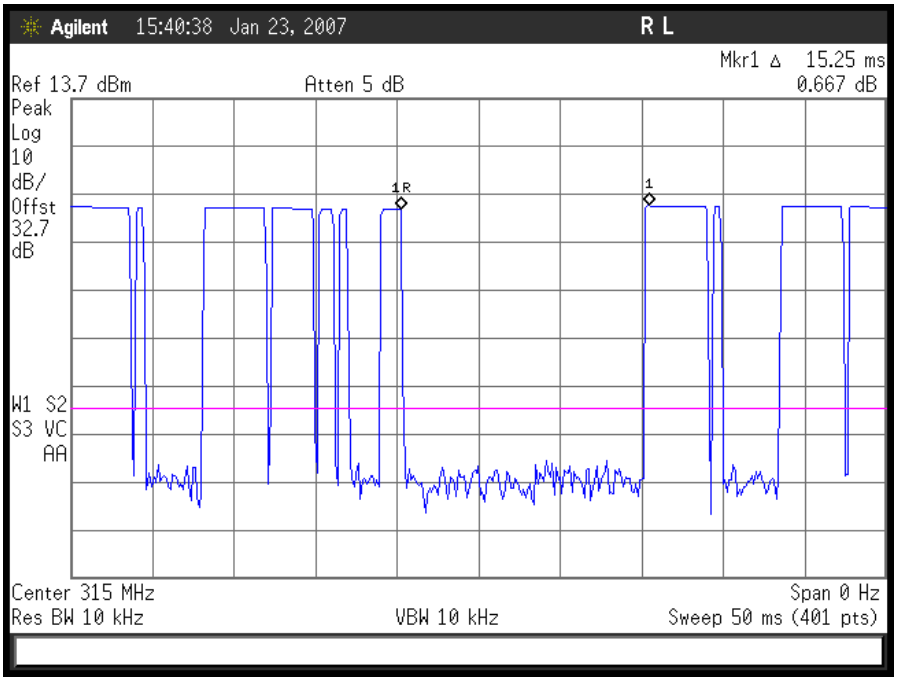
## Periodic Intentional Radiator, Section 15.35 (a), Transmitter Duty Cycle Test Results

**Remarks:** The duty cycle of one pulsed cycle was found to be 33.85%. This being greater than 0.1 sec, the measured field strength was determined from the average absolute voltage during a 0.1 sec interval during which the field strength was at a maximum.

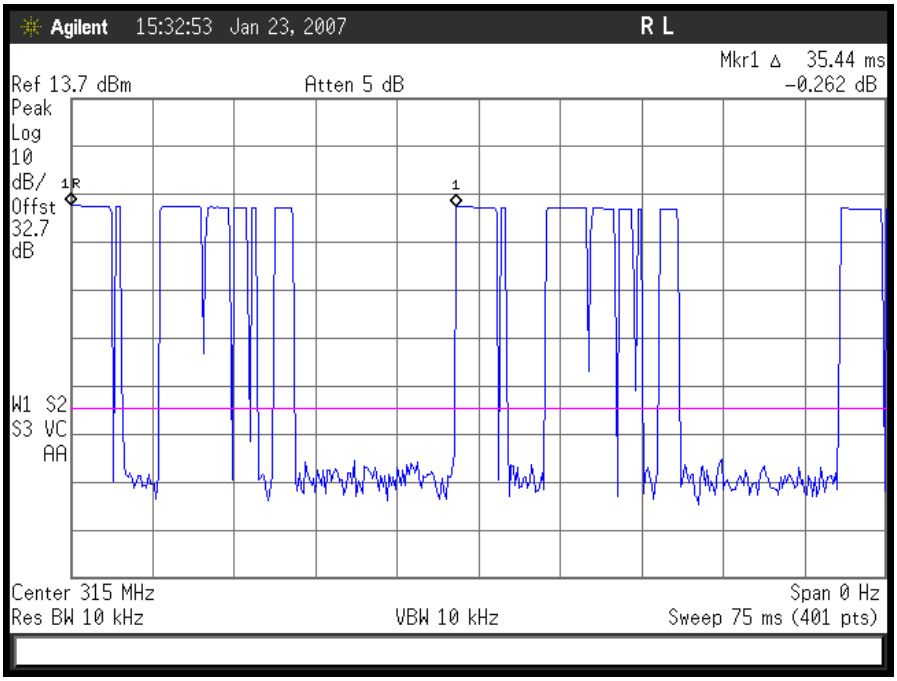
$TX_{ON}$ = 11.995 ms
$TX_{OFF}$ = 23.445 ms
Duty cycle = 11.995ms/35.44ms=33.85%




**Plot 1. Total Duration of Pulses**




**Plot 2. Off Time Between Pulse Packets – Part A**




**Plot 3. Off Time Between Pulse Packets – Part B**

# 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.

| Test Name: Spurious Radiated Emissions | | | | | Test Date(s): 12/20/2006 |
|---|---|---|---|---|---|
| **MET Asset #** | **Nomenclature** | **Manufacturer** | **Model** | **Last Cal Date** | **Cal Due Date** |
| 1S2121 | PreAmplifier | HP | 8449B | 11/28/2006 | 11/28/2007 |
| 1S2198 | Horn Antenna | EMCO | 3115 | 08/17/2006 | 08/17/2007 |
| 1S2263 | 10 Meter Chamber | Rantec | N2-14 | 08/15/2006 | 08/15/2007 |
| 1S2421 | EMI Test Receiver | Rohde & Schwarz | ESIB7 | 03/22/2006 | 03/22/2007 |
| 1S2460 | Spectrum Analyzer | Agilent | E4407B | 01/24/2006 | 01/24/2007 |

1. §15.231(a). The provisions of this Section are restricted to periodic operation within the band 40.66-40.70MHz and above 70MHz. Except as shown in paragraph (e) of this Section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Radio control of toys is not permitted. Continuous transmission, such as voice or video, and data transmission are not permitted. The prohibition against data transmission does not preclude the use of recognition codes. Those codes are used to identify the sensor that is activated or to identify the particular component as being part of the system.

   Results:
   The EUT is similar to a remote switch and meets the requirements of this section.

2. §15.231(a1). A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

   Results
   The transmitter will cease transmission immediately after being released but will transmitter no greater than 5 seconds if keyed continually.

3. §15.231(a2). A transmitter activated automatically shall cease transmission within 5 seconds after action.

   Results: The EUT does not have automatic transmission.

4. §15.231(a3). Periodic transmission at regular predetermined intervals are not permitted. However, polling or supervision transmission to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of the transmission does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

   Results: The EUT does not employ periodic transmission.

5. §15.231(a4). Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate the pendency of the alarm condition.

   Results: This section does not apply to the EUT

# 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

## B. 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 B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

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

– Reorient or relocate the receiving antenna.

– Increase the separation between the equipment and receiver.

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

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

# End of Report