



MET Laboratories, Inc.

Safety Certification - EMI - Telecom Environmental Simulation

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February 9, 2012

Marshall Radio Telemetry
896 West 100 North
North Salt Lake, Utah 84054

Dear Kevin Harcourt,

Enclosed is the EMC Wireless test report for compliance testing of the Marshall Radio Telemetry, Personal Locating Device (model PLD-010) 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 95, Subpart G, RSS-210, Issue 8, Dec. 2010 for Intentional Radiators.

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

Sincerely yours,
MET LABORATORIES, INC.

Jennifer Warnell
Documentation Department

Reference: (\Marshall Radio Telemetry\EMCS32594-FCC95G Rev. 1)

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Marshall Radio Telemetry

Personal Locating Device (model PLD-010)

Electromagnetic Compatibility

Cover Page

CFR Title 47, Part 15B, Part 95G; RSS-210, Issue 8, Dec. 2010 & ICES-003

Electromagnetic Compatibility Criteria Test Report

for the

**Marshall Radio Telemetry
Personal Locating Device (model PLD-010)**

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Parts 15 Subpart B & ICES-003
for Class B Digital Devices
&
Part 95, Subpart G & RSS-210, Issue 8, Dec. 2010
for Intentional Radiators

MET Report: EMCS32594-FCC95G Rev. 1

February 9, 2012

Prepared For:

**Marshall Radio Telemetry
896 West 100 North
North Salt Lake, Utah 84054**

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



Electromagnetic Compatibility Criteria Test Report

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Marshall Radio Telemetry Personal Locating Device (model PLD-010)

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the FCC Certification Rules
contained in
Title 47 of the CFR, Parts 15 Subpart B & ICES-003
for Class B Digital Devices
&
Part 95, Subpart G & RSS-210, Issue 8, Dec. 2010
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, Part 95G and Industry Canada standards ICES-003, Issue 4 February 2004, RSS-210, Issue 8, Dec. 2010 under normal use and maintenance.

Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab

Draft Status Sheet

| Draft Revision | Draft Date | Reason for Draft Revision |
|----------------|-------------------|--|
| Ø | December 19, 2011 | Draft Issue. |
| 1 | February 9, 2012 | Revised to reflect engineer corrections. |



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Personal Locating Device (model PLD-010)

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Marshall Radio Telemetry

Personal Locating Device (model PLD-010)

Electromagnetic Compatibility

List of Terms and Abbreviations

CFR Title 47, Part 15B, Part 95G; RSS-210, Issue 8, Dec. 2010 & ICES-003

List of Terms and Abbreviations

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



Marshall Radio Telemetry
Personal Locating Device (model PLD-010)

Electromagnetic Compatibility
Executive Summary
CFR Title 47, Part 15B, Part 95G; RSS-210, Issue 8, Dec. 2010 & ICES-003

I. Executive Summary



A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Marshall Radio Telemetry Personal Locating Device (model PLD-010), with the requirements of Part 15, §Part 95G. 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 Personal Locating Device (model PLD-010). Marshall Radio Telemetry should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Personal Locating Device (model PLD-010), 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, §Part 95G, in accordance with Marshall Radio Telemetry, purchase order number 705335. All tests were conducted using measurement procedure ANSI C63.4-2003.

| FCC Reference 47 CFR Part 95G:2005 | IC Reference RSS-210 Issue 8: 2010; RSS-GEN Issue 3: 2010 | Description | Compliance |
|---------------------------------------|---|---|----------------|
| 47 CFR Part 15.107 (a) | ICES-003 Issue 4 February 2004 | Conducted Emission Limits for a Class B Digital Device | Not Applicable |
| 47 CFR Part 15.109 (a) | ICES-003 Issue 4 February 2004 | Radiated Emission Limits for a Class B Digital Device | Compliant |
| 47 CFR Part 2.1049 | RSS-Gen(4.6) | Occupied Bandwidth | Compliant |
| 47 CFR Part 2.1046; 95.639(e) | RSS-210(A8.4) | Peak Power Output | Compliant |
| 47 CFR Part 2.1053; 95.635(c)(3) | RSS-210(A8.5) | Radiated Spurious Emissions | Compliant |
| 47 CFR Part 2.1051 | RSS-210(A8.5) | Spurious Emissions at Antenna Terminals | Not Applicable |
| 47 CFR Part 2.1055, 95.635(d)(2) | RSS-210(A8.5) | Frequency Stability | Compliant |
| N/A | RSS-Gen(4.10) | Receiver Spurious Emissions | Compliant |

Table 1. Executive Summary of EMC Part Part 95G Compliance Testing



Marshall Radio Telemetry
Personal Locating Device (model PLD-010)

Electromagnetic Compatibility
Equipment Configuration
CFR Title 47, Part 15B, Part 95G; RSS-210, Issue 8, Dec. 2010 & ICES-003

II. Equipment Configuration



Marshall Radio Telemetry

Personal Locating Device (model PLD-010)

Electromagnetic Compatibility
Equipment Configuration

CFR Title 47, Part 15B, Part 95G; RSS-210, Issue 8, Dec. 2010 & ICES-003

A. Overview

MET Laboratories, Inc. was contracted by Marshall Radio Telemetry to perform testing on the Personal Locating Device (model PLD-010), under Marshall Radio Telemetry's purchase order number 705335.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Marshall Radio Telemetry, Personal Locating Device (model PLD-010).

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

| | |
|----------------------------|---|
| Model(s) Tested: | Personal Locating Device (model PLD-010) |
| Model(s) Covered: | Personal Locating Device (model PLD-010) |
| EUT Specifications: | Primary Power: 3 VDC |
| | FCC ID: Z4Q-PLD-010-001 |
| | IC: 9979A-010 |
| | Type of Modulations: Pulsed CW |
| | Peak RF Output Power: -20.74dBm Peak |
| Analysis: | EUT Frequency Ranges: 216.000 – 217.000 MHz |
| | The results obtained relate only to the item(s) tested. |
| | Temperature: 15-35° C |
| | Relative Humidity: 30-60% |
| | Barometric Pressure: 860-1060 mbar |
| Evaluated by: | Anderson Soungpanya |
| Report Date(s): | February 9, 2012 |

Table 2. EUT Summary Table



B. References

| | |
|--|--|
| CFR 47, Part 95, Subpart G | Federal Communication Commission, Code of Federal Regulations, Title 47, Part 95G: Low Power Radio Service (LPRS) |
| CFR 47, Part 15, Subpart B | Electromagnetic Compatibility: Criteria for Radio Frequency Devices |
| RSS-210, Issue 8, Dec. 2010 | Low-power Licence-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment |
| RSS-GEN, Issue 3, Dec. 2010 | General Requirements and Information for the Certification of Radio Apparatus |
| 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 |
| ANSI C63.10-2009 | American National Standard for Testing Unlicensed Wireless Devices |

Table 3. References

C. Test Site

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

Radiated Emissions measurements were performed in a 5 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 Marshall Radio Telemetry Personal Locating Device (model PLD-010), Equipment Under Test (EUT), is Emergency Personal Locating Device – used to track and locate persons with disabilities.

The PLD-010 is a wrist worn VHF transmitter, worn by patients with special needs (Autism, dementia, Alzheimer's, etc.). The intended use of the device is to allow searchers to locate, and safely recover the individual if that individual has become lost.



Photograph 1. Marshall Radio Telemetry Personal Locating Device (model PLD-010)

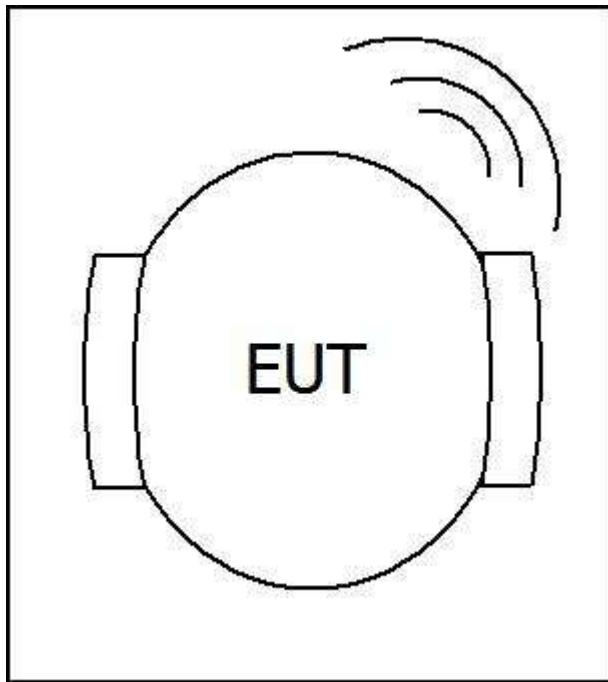


Figure 1. Block Diagram of Test Configuration



E. Equipment Configuration

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

| Ref. ID | Name / Description | Model Number | Serial Number |
|---------|------------------------------------|--------------|---------------|
| 1 | Emergency Personal Locating Device | PLD-010-001 | 00001 |

Table 4. Equipment Configuration

F. Support Equipment

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

| Ref. ID | Name / Description | Manufacturer | Model Number |
|---------|--------------------|--------------|--------------|
| 2 | CR2450 Battery | Energizer | CR2450 |

Table 5. Support Equipment

G. Mode of Operation

Upon installation of the battery, the device enters it's one and only 'active' state, which is to continually transmit an RF pulse (roughly once every second) for the duration of the battery's life (approx. 30-60 days). Operation ceases when either the internal battery is depleted, or when the battery is removed by the care giver or responsible party.

The PLD-010 utilizes a responsible-party-accessible lithium battery to power the device.

H. Method of Monitoring EUT Operation

The PLD-010 is intended to be used in conjunction with a tracking receiver (used by trained personnel such as local law enforcement, emergency responders, search and rescue, etc.). The device is deemed to be functional if a signal can be received and heard using the appropriate RF receiver. In addition, a 'Transmitter Tester' is to be used by the care giver to check normal operation of the PLD on a daily basis.

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 Marshall Radio Telemetry upon completion of testing.



Marshall Radio Telemetry
Personal Locating Device (model PLD-010)

Electromagnetic Compatibility
Unintentional Radiators
CFR Title 47, Part 15B, Part 95G; RSS-210, Issue 8, Dec. 2010 & ICES-003

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 6. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

15.107 (b) For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 6. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

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 6, as measured using a 50 μ H/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 (dB μ V) | | *Class B Conducted Limits (dB μ V) | |
|--------------------------|--|---------|---|---------|
| | 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 6. 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 not applicable with the Class B requirement(s) of this section. The EUT is battery powered.



Radiated Emission Limits

§ 15.109 Radiated Emissions Limits

Test Requirement(s):

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

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

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

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

Test Procedures:

The EUT was placed on a non-metallic table, 80 cm above the ground plane 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.

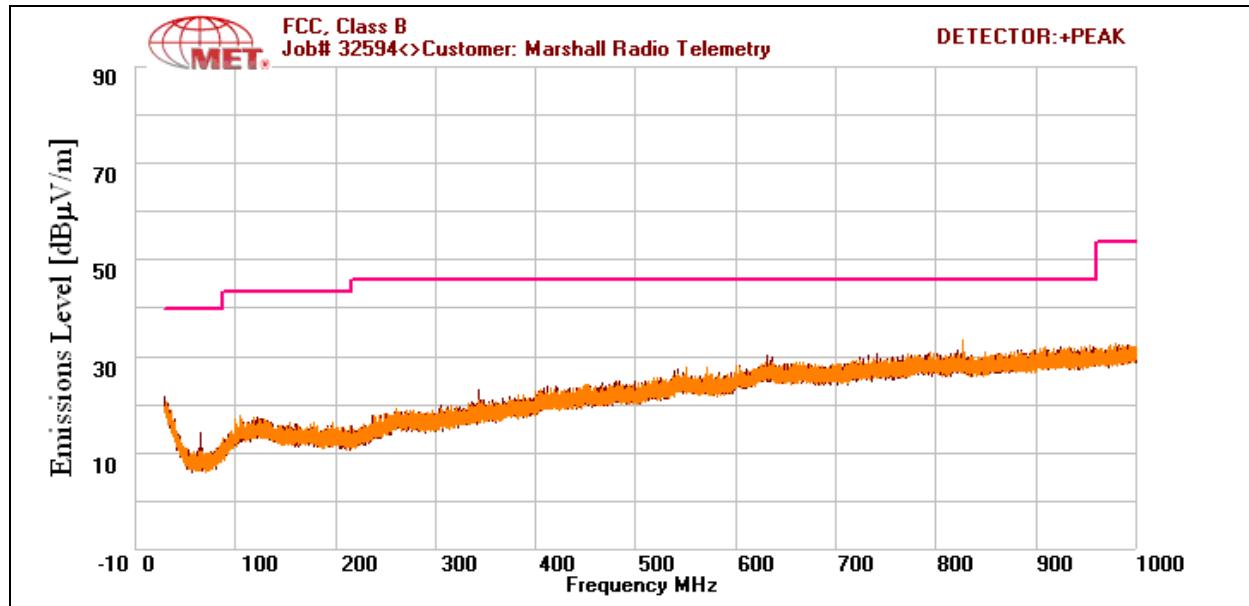
Test Engineer(s): Anderson Soungpanya

Test Date(s): 10/11/11

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) | Limit (dBuV) | Margin (dB) |
|-----------------|------------------|-----------------------|---------------------|------------------------------|------------|-------------------|----------|----------|----------------------------|--------------|-------------|
| 33.68 | V | 10 | 100 | 2.22 | 16.492 | 0 | 1.355 | 0 | 20.067 | 40 | -19.933 |
| 33.68 | H | 15 | 100 | 2.54 | 16.492 | 0 | 1.355 | 0 | 20.387 | 40 | -19.613 |
| 68.88 | H | 156 | 100 | 1.14 | 6.388 | 0 | 2.19 | 0 | 9.718 | 40 | -30.282 |
| 343.41 | H | 200 | 100 | 1.55 | 14.236 | 0 | 3.822 | 0 | 19.608 | 46 | -26.392 |
| 630.1 | H | 133 | 100 | 1.05 | 19.598 | 0 | 5.349 | 0 | 25.997 | 46 | -20.003 |
| 830.14 | V | 175 | 100 | 1.12 | 19.894 | 0 | 6.32 | 0 | 27.334 | 46 | -18.666 |

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

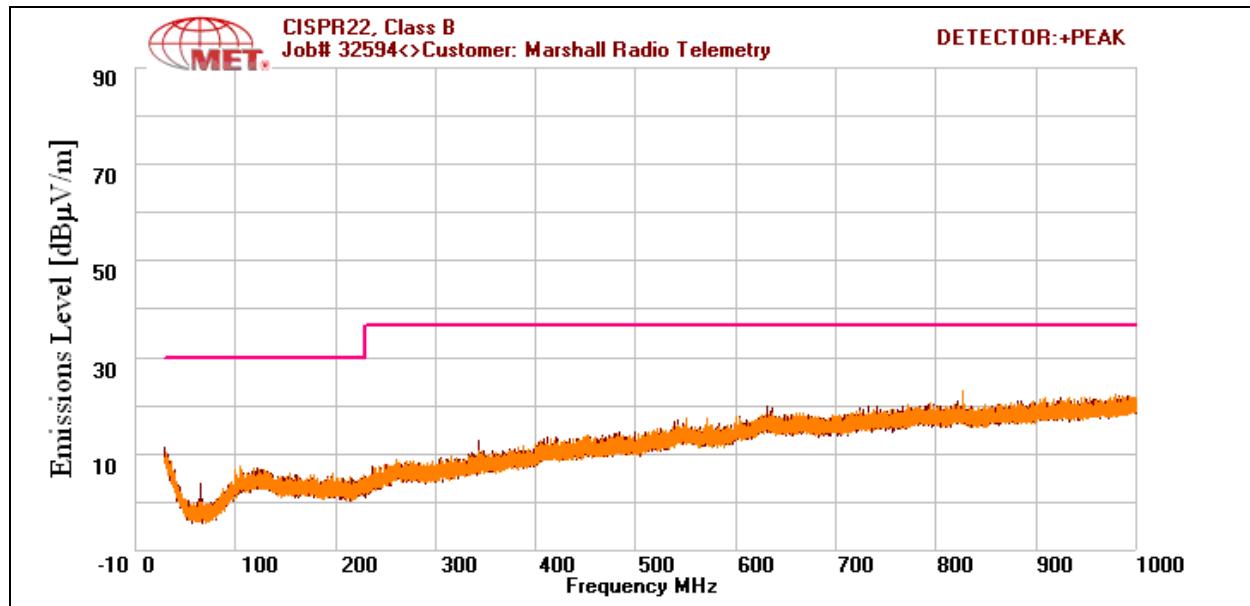


Plot 1. Radiated Emissions, 30 MHz - 1 GHz, FCC Limits

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) | Limit (dBuV) | Margin (dB) |
|-----------------|------------------|-----------------------|---------------------|------------------------------|------------|-------------------|----------|----------|----------------------------|--------------|-------------|
| 33.68 | V | 10 | 100 | 2.22 | 16.492 | 0 | 1.355 | -10.46 | 9.607 | 30 | -20.393 |
| 33.68 | H | 15 | 100 | 2.54 | 16.492 | 0 | 1.355 | -10.46 | 9.927 | 30 | -20.073 |
| 68.88 | H | 156 | 100 | 1.14 | 6.388 | 0 | 2.19 | -10.46 | -0.742 | 30 | -30.742 |
| 343.41 | H | 200 | 100 | 1.55 | 14.236 | 0 | 3.822 | -10.46 | 9.148 | 37 | -27.852 |
| 630.1 | H | 133 | 100 | 1.05 | 19.598 | 0 | 5.349 | -10.46 | 15.537 | 37 | -21.463 |
| 830.14 | V | 175 | 100 | 1.12 | 19.894 | 0 | 6.32 | -10.46 | 16.874 | 37 | -20.126 |

Table 9. Radiated Emissions Limits, Test Results, ICES-003 Limits



Plot 2. Radiated Emissions, ICES-003 Limits

Radiated Emission Limits Test Setup



Photograph 2. Radiated Emission, Test Setup, Front View



Photograph 3. Radiated Emission, Test Setup, Rear View



Photograph 4. Radiated Emission, Test Setup, Bilog Setup



Marshall Radio Telemetry
Personal Locating Device (model PLD-010)

Electromagnetic Compatibility
Test Equipment
CFR Title 47, Part 15B, Part 95G; RSS-210, Issue 8, Dec. 2010 & ICES-003

IV. Electromagnetic Compatibility Criteria for Intentional Radiators



Electromagnetic Compatibility Criteria for Intentional Radiators

§95.639(e) RF Power Output

Test Requirement: §95.639(e)

Test Procedures: EUT placed 1m high on a table inside a semi-anechoic chamber. EUT was set to transmit at Low, Mid and High Channels. The field strength of the carrier was maximized by azimuth (0-360 degrees) and antenna height (1-4m). The peak measurement was taken. The EUT was replaced with a signal source and antenna. The signal source was adjusted to match the field strength recorded when the EUT was measured. Table below shows the calculation for ERP.

Limits: 100 mW (20 dBm) ERP

Test Results: The EUT is compliant with 95.639(2) for Low Power Radio Stations.

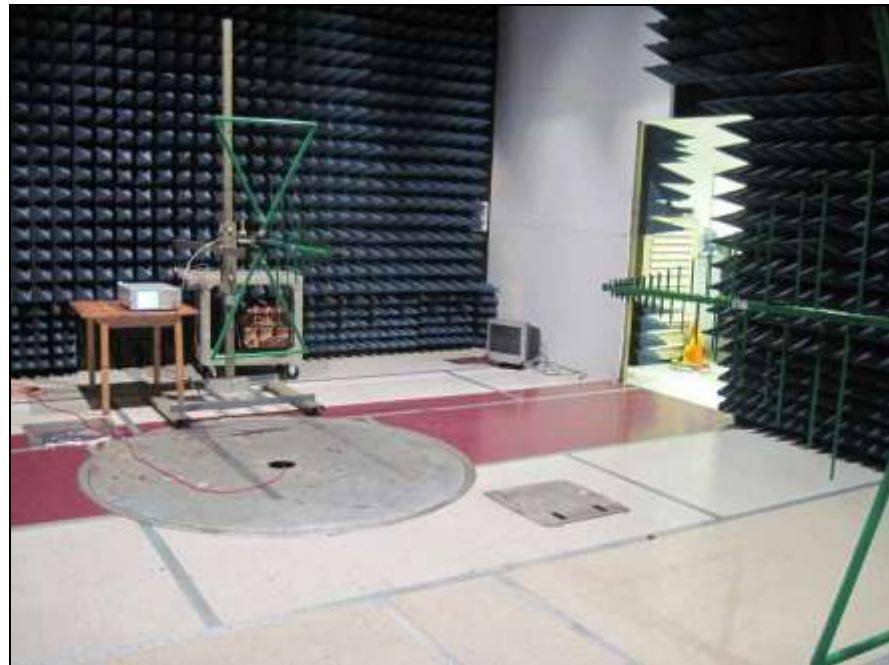
Test Engineer(s): Anderson Soungpanya

Test Date(s): 10/11/11

| Channel | Frequency MHz | Signal Output Level dBm | Antenna Gain dBi | dB _i to dB _d Correction Factor dB | Cable Loss dB | ERP dBm |
|---------|---------------|-------------------------|------------------|---|---------------|---------|
| Low | 216.0125 | -25.5 | 6.1 | -2.14 | 0.2 | -21.74 |
| Mid | 216.4875 | -24.5 | 6.1 | -2.14 | 0.2 | -20.74 |
| High | 216.9875 | -25.1 | 6.1 | -2.14 | 0.2 | -21.34 |

Table 10. RF Output Power, Test Results

ERP = Signal Output level + Antenna Gain (dB_i) + dB_i to dB_d Correction Factor - Cable Loss



Photograph 5. ERP, Test Setup



Photograph 6. Radiated Biolog



Marshall Radio Telemetry
Personal Locating Device (model PLD-010)

Electromagnetic Compatibility
Test Equipment
CFR Title 47, Part 15B, Part 95G; RSS-210, Issue 8, Dec. 2010 & ICES-003



Photograph 7. Radiated Setup



Electromagnetic Compatibility Criteria for Intentional Radiators

§95.635(c)(3) Occupied Bandwidth

Test Requirement(s): §95.635(c)(3) & §2.1049

Test Procedures: An antenna was placed next to the EUT to capture the full bandwidth. The antenna was connected to a spectrum analyzer. Measurements were performed at the low, mid and high channels for each of the EUT's bandwidths and modulations.

Emission mask from 95.635(c) was used.

Test Results: Equipment is compliant with Section 2.1049 & 95.635(c).

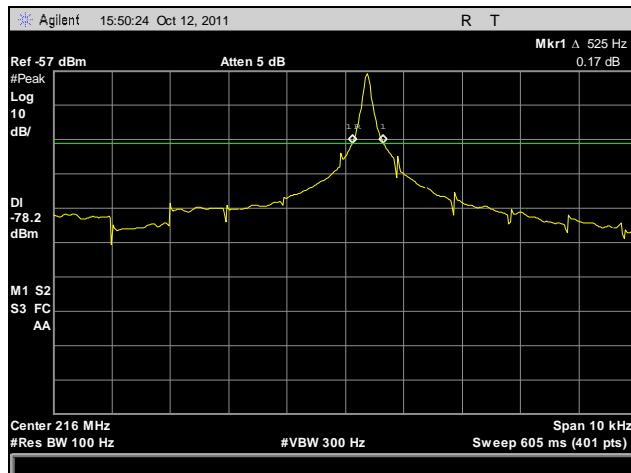
The following pages show measurements of occupied band width.

Test Engineer(s): Anderson Soungpanya

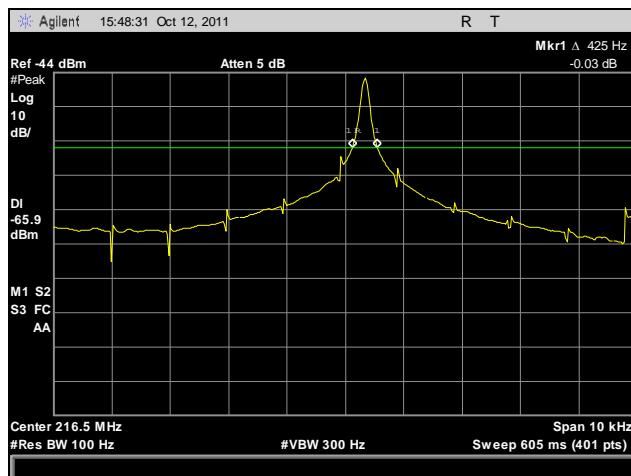
Test Date(s): 10/12/11



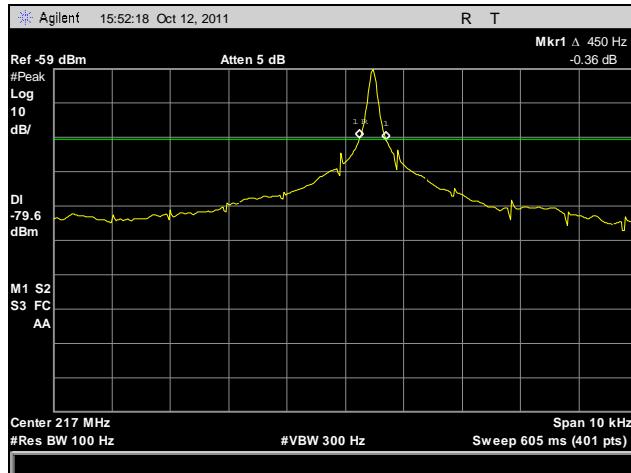
Occupied Bandwidth Results



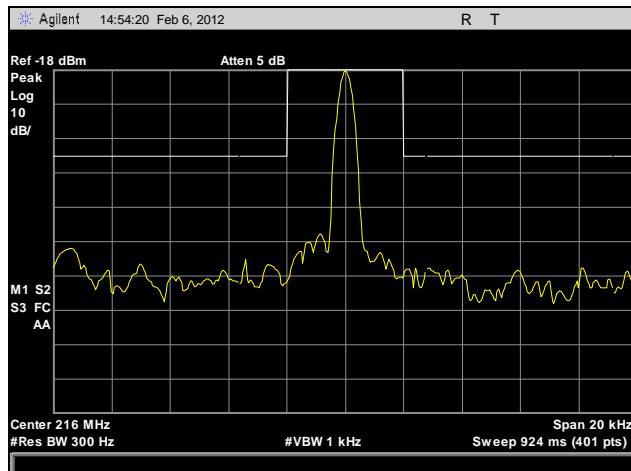
Plot 3. Occupied Bandwidth, Low Channel



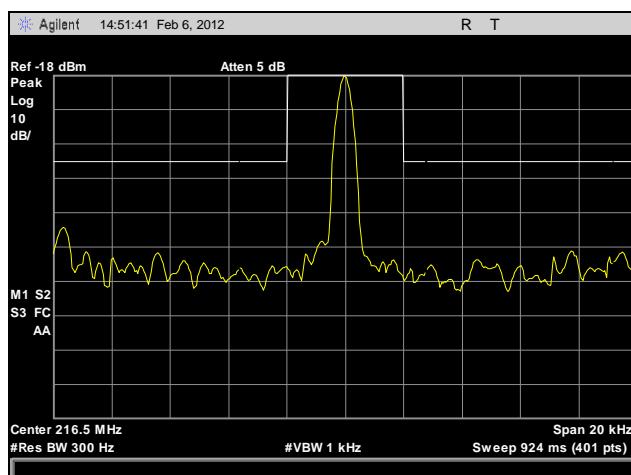
Plot 4. Occupied Bandwidth, Mid Channel



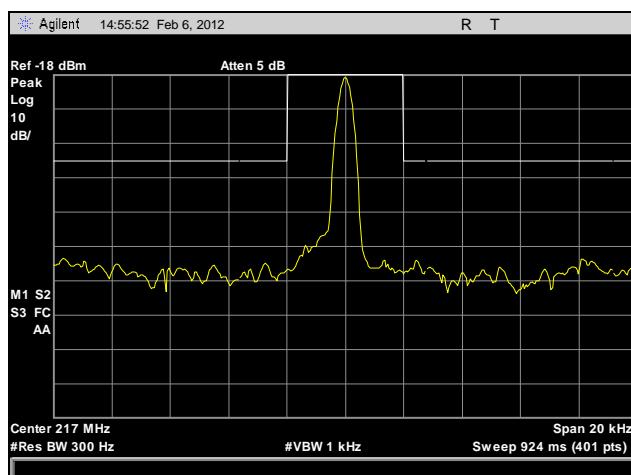
Plot 5. Occupied Bandwidth, High Channel



Plot 6. Emission Mask, Low Channel



Plot 7. Emission Mask, Mid Channel



Plot 8. Emission Mask, High Channel

Electromagnetic Compatibility Criteria for Intentional Radiators

§95.635(c) Radiated Spurious Emissions

Test Requirement(s): §95.635(c) & §2.1053 and TIA/EIA-603-A-2001

Test Procedures: As required by 47 CFR 2.1053, *field strength of radiated spurious measurements* were made in accordance with the procedures of TIA/EIA-603-A-2001 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards".

Radiated emission measurements were performed inside a 3 meter semi-anechoic chamber. The EUT was set at a distance of 3m from the receiving antenna. The EUT was set to transmit at the low, mid and high channels of the transmitter frequency range at its maximum power level. The EUT was rotated about 360⁰ and the receiving antenna scanned from 1-4m in order to capture the maximum emission. For harmonic frequencies falling in restricted bands the corrected field strength was performed using antenna factor and cable loss method. For all other notable spurious emissions a calibrated antenna source was positioned in place of the EUT and the previously recorded signal was duplicated. The maximum EIRP of the emission was calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps were carried out with the receiving antenna in both vertical and horizontal polarization. Harmonic emissions up to the 10th or 40GHz, which ever was the lesser, were investigated.

Test Results: Equipment is compliant with Section 95.635(c), 2.1053 and TIA/EIA-603-A-2001.

Radiated spurious needs to be attenuated at least $55 + 10 \log_{10}(P)$ dB
Limit Value works out to be -25dB

The following formula was used to derive the limit in terms of field strength

$$\text{dBm} = Eo - 9.54 + 104.8$$

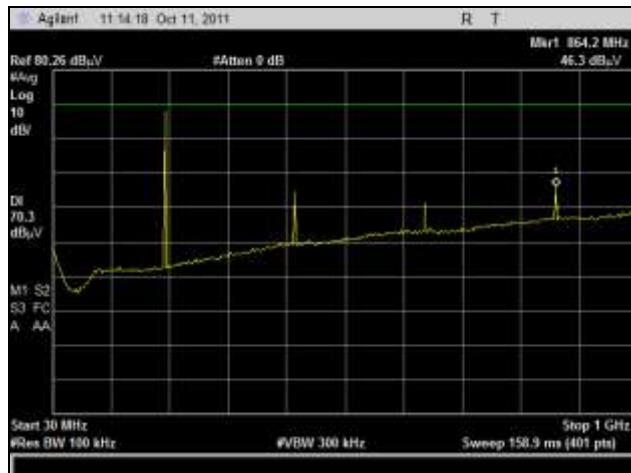
Eo = 70.26 dB_{uV/m} is the limit corrected

Test Engineer(s): Anderson Soungpanya

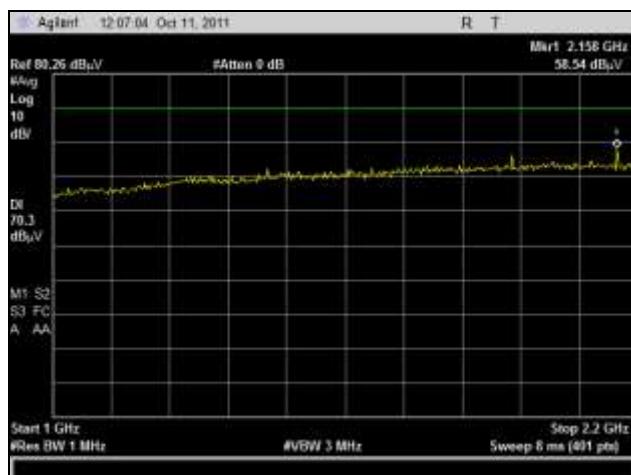
Test Date(s): 10/11/11



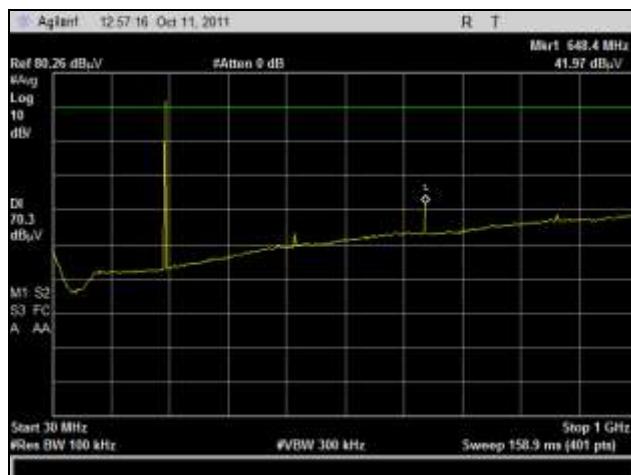
Radiated Spurious Emissions



Plot 9. Radiated Spurious, Low Channel, 30 MHz – 1 GHz



Plot 10. Radiated Spurious, Low Channel, 1 GHz – 2.2 GHz



Plot 11. Radiated Spurious, Mid Channel, 30 MHz – 1 GHz

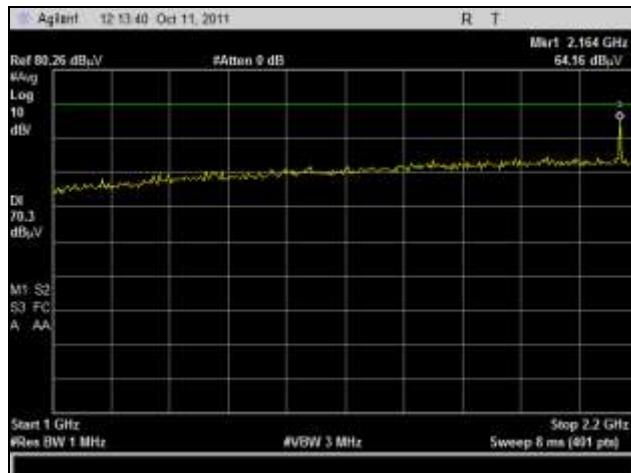


Marshall Radio Telemetry

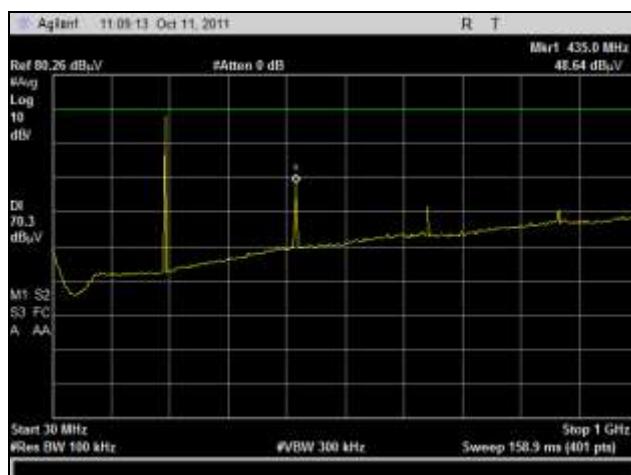
Personal Locating Device (model PLD-010)

Electromagnetic Compatibility
Test Equipment

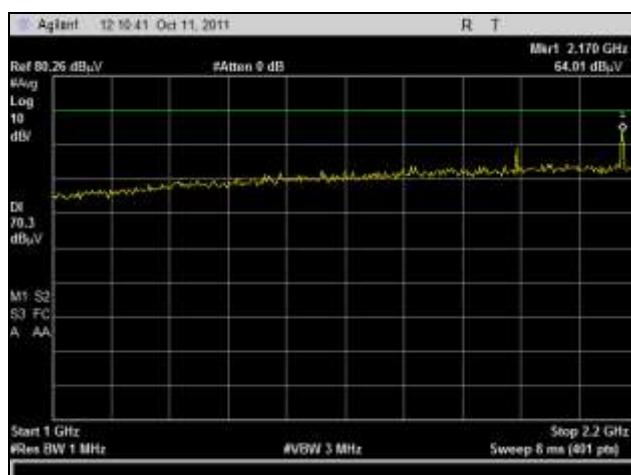
CFR Title 47, Part 15B, Part 95G; RSS-210, Issue 8, Dec. 2010 & ICES-003



Plot 12. Radiated Spurious, Mid Channel, 1 GHz – 2.2 GHz



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



Plot 14. Radiated Spurious, High Channel, 1 GHz – 2.2 GHz



Photograph 8. Radiated Spurious Emission, Test Setup



Photograph 9. Radiated Spurious Emissions, Bilog



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Test Equipment
CFR Title 47, Part 15B, Part 95G; RSS-210, Issue 8, Dec. 2010 & ICES-003



Photograph 10. Radiated Spurious Emissions, Horn



Electromagnetic Compatibility Criteria for Intentional Radiators

§95.629(d)(2) Frequency Stability

Test Requirement(s): **§2.1055 and §95.629**

Test Procedures: As required by 47 CFR 2.1055, *Frequency Stability measurements* were made at the RF output terminals using a Directional Coupler through a Spectrum Analyzer and Power Meter.

The EUT was placed in the Environmental Chamber and support equipment are outside the chamber on a table. The EUT was set to transmitter at a data rate corresponding to 20MHz BW. The frequency counter option on the Spectrum Analyzer was used to measure frequency deviations. The frequency drift was investigated for every 10^C increment until the unit is stabilized then recorded the reading in tabular format with the temperature range of -30 to 50^C .

Voltage supplied to EUT is 120 VAC reference temperature was done at 20^C . The voltage was varied by $\pm 15\%$ of nominal

Test Results: Equipment is compliant with Section 95.629, 2.1055 and 90.213.

Test Engineer(s): Anderson Soungpanya

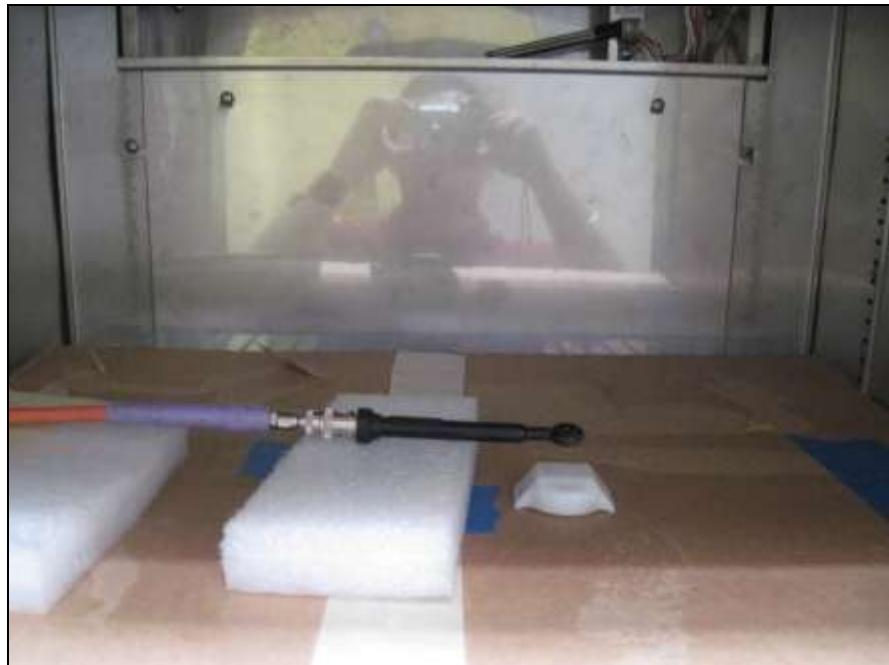
Test Date(s): 10/13/11



Frequency Stability Test Results

| Reference Frequency (MHz) | Temperature (C) | Measured (MHz) | Δ ppm |
|---------------------------|-------------------|----------------|-------|
| 216.48450 | -30 | 216.48430 | 0.92 |
| | -20 | 216.48440 | 0.46 |
| | -10 | 216.48450 | 0.00 |
| | 0 | 216.48450 | 0.00 |
| | 10 | 216.48450 | 0.00 |
| | 20 | 216.48450 | 0.00 |
| | 30 | 216.48455 | 0.23 |
| | 40 | 216.48455 | 0.23 |
| | 50 | 216.48455 | 0.23 |
| Reference Frequency (MHz) | Voltage (DC) | Measured (MHz) | Δ ppm |
| 216.48450 | 1.4 | 216.48455 | 0.23 |
| | 3 | 216.48450 | 0.00 |
| | 3.5 | 216.48455 | 0.23 |

Table 11. Frequency Stability, Test Results



Photograph 11. Frequency Stability, Test Chamber



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CFR Title 47, Part 15B, Part 95G; RSS-210, Issue 8, Dec. 2010 & ICES-003

Electromagnetic Compatibility Criteria for Intentional Radiators

RSS-GEN Receiver Spurious Emission Requirements

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

(a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 12.

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

Table 12. Spurious Emission Limits for Receivers

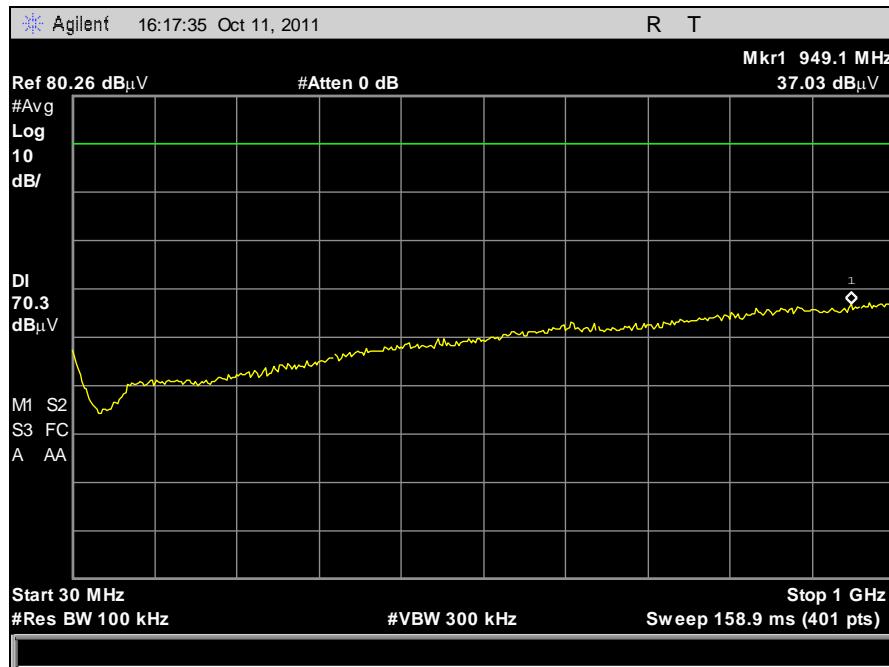
(b) If a conducted measurement is made, no spurious output signals appearing at the antenna terminals shall exceed 2 nanowatts per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5 nanowatts above 1 GHz.

Test Procedures: Radiated measurements were taken at 3m.

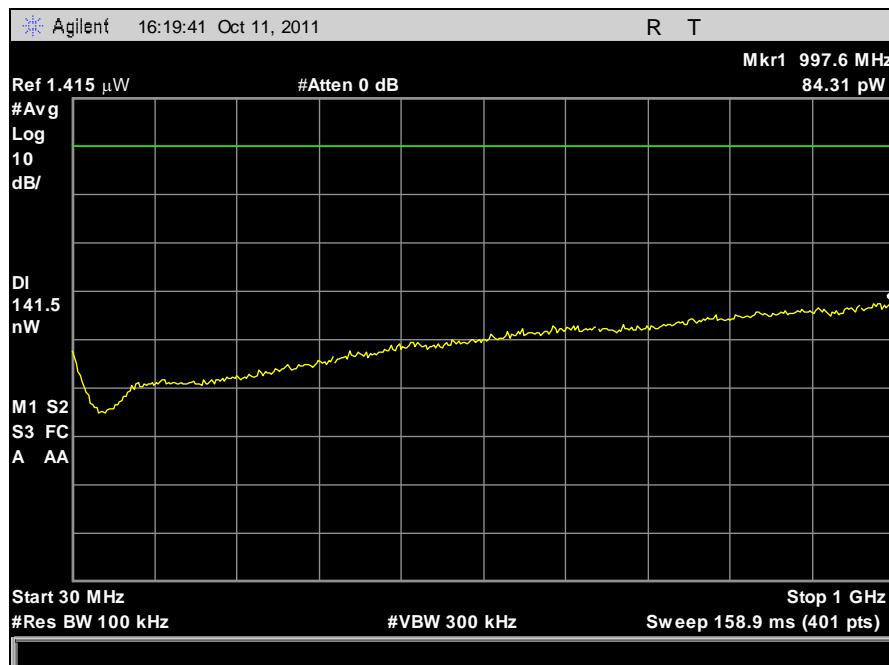
Test Results: Equipment is compliant with the Receiver Spurious Emissions Requirements of RSS-GEN.

Test Engineer(s): Anderson Soungpanya

Test Date(s): 10/13/11



Plot 15. Receiver Spurious Emissions, 30 MHz – 1 GHz



Plot 16. Receiver Spurious Emissions, 30 MHz – 1 GHz, Watts



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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 |
|-------------|----------------------|---------------|----------|---------------|--------------|
| 1S2603 | HORN ANTENNA | ETS-LINDGREN | 3117 | 05/9/2011 | 05/9/2012 |
| 1S2583 | ANALYZER, SPECTRUM | AGILENT | E4447A | 03/18/2011 | 03/18/2012 |
| 1S2460 | ANALYZER, SPECTRUM | AGILENT | E4407B | 07/12/2011 | 07/12/2012 |
| 1S2482 | CHAMBER, 5 METER | PANASHIELD | 641431 | 11/13/2010 | 11/13/2011 |
| 1S2399 | TURNTABLE CONTROLLER | SUNOL SCIENCE | SC99V | SEE NOTE | |
| 1S2229 | TEMPERATURE CHAMBER | TENNY | T6 | 02/18/2011 | 02/18/2012 |
| 1S2484 | BILOG ANTENNA | TESEQ | CBL6112D | 02/27/2011 | 02/27/2012 |

Table 13. Test Equipment List

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



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V. Certification & User's Manual Information

Certification & User's Manual Information

A. Certification Information

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

§ 2.801 Radio-frequency device defined.

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

- (a) The various types of radio communication transmitting devices described throughout this chapter.
- (b) *The incidental, unintentional and intentional radiators defined in Part 15 of this chapter.*
- (c) The industrial, scientific, and medical equipment described in Part 18 of this chapter.
- (d) Any part or component thereof which in use emits radio-frequency energy by radiation, conduction, or other means.

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

- (a) Except as provided elsewhere in this chapter, no person shall sell or lease, or offer for sale or lease (including advertising for sale or lease), or import, ship or distribute for the purpose of selling or leasing or offering for sale or lease, any radio frequency device unless:
 - (1) In the case of a device subject to certification, such device has been authorized by the Commission in accordance with the rules in this chapter and is properly identified and labeled as required by §2.925 and other relevant sections in this chapter; or
 - (2) In the case of a device that is not required to have a grant of equipment authorization issued by the Commission, but which must comply with the specified technical standards prior to use, such device also complies with all applicable administrative (including verification of the equipment or authorization under a Declaration of Conformity, where required), technical, labeling and identification requirements specified in this chapter.
- (d) Notwithstanding the provisions of paragraph (a) of this section, the offer for sale solely to business, commercial, industrial, scientific or medical users (but not an offer for sale to other parties or to end users located in a residential environment) of a radio frequency device that is in the conceptual, developmental, design or pre-production stage is permitted prior to equipment authorization or, for devices not subject to the equipment authorization requirements, prior to a determination of compliance with the applicable technical requirements *provided* that the prospective buyer is advised in writing at the time of the offer for sale that the equipment is subject to the FCC rules and that the equipment will comply with the appropriate rules before delivery to the buyer or to centers of distribution.

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

- (i) *Compliance testing;*
- (ii) Demonstrations at a trade show provided the notice contained in paragraph (c) of this section is displayed in a conspicuous location on, or immediately adjacent to, the device;
- (iii) Demonstrations at an exhibition conducted at a business, commercial, industrial, scientific or medical location, but excluding locations in a residential environment, provided the notice contained in paragraphs (c) or (d) of this section, as appropriate, is displayed in a conspicuous location on, or immediately adjacent to, the device;
- (iv) Evaluation of product performance and determination of customer acceptability, provided such operation takes place at the manufacturer's facilities during developmental, design or pre-production stages; or
- (v) Evaluation of product performance and determination of customer acceptability where customer acceptability of a radio frequency device cannot be determined at the manufacturer's facilities because of size or unique capability of the device, provided the device is operated at a business, commercial, industrial, scientific or medical user's site, but not at a residential site, during the development, design or pre-production stages.

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

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

Certification & User's Manual Information

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

§ 2.901 Basis and Purpose

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

§ 2.907 Certification.

- (a) Certification is an equipment authorization issued by the Commission, based on representation and test data submitted by the applicant.
- (b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

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

Certification & User's Manual Information

§ 2.948 Description of measurement facilities.

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

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

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

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

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

Certification & User's Manual Information

1. Label and User's Manual Information

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

§ 15.19 Labeling requirements.

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

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

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

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

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

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

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

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

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

§ 15.21 Information to user.

The 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.



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End of Report