1601 FM 1460, Suite B
Round Rock, TX 78664
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July 12, 2006

Lennie Reeh
Latest Advanced Digital Solutions, Inc.
8102 Yaupon Drive
Austin TX 78759

Dear Mr. Reeh:

Enclosed is the Electromagnetic Compatibility Test Report for the In Dispenser Module (IDM).

This report can be utilized to demonstrate compliance with FCC Part 15, Class B.

If you have any questions, please contact me.

Sincerely,

Michael A. Royer
EMC Department Manager

Enclosure

Project 06238-10

Latest Advanced Digital Solutions, Inc.
**In Dispenser Module**
**(IDM)**

# Electromagnetic Compatibility Test Report

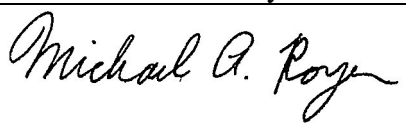
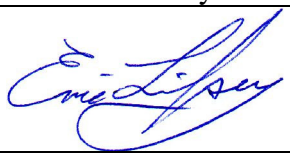
Prepared for:

Latest Advanced Digital Solutions, Inc.
8102 Yaupon Drive
Austin TX 78759

By

Professional Testing (EMI), Inc.
1601 FM 1460, Suite B
Round Rock, Texas 78664

JULY 12, 2006

| Reviewed by | Written by |
|---|---|
|  |  |
| Michael Royer<br>EMC Department Manager | Eric Lifsey<br>EMC Engineer |

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# Certificate Of Compliance

Applicant: Latest Advanced Digital Solutions, Inc.

Applicant's Address: 8102 Yaupon Drive
Austin TX 78759

Project Number: PTI 06238-10

Test Dates: December 18, 2005 - January 26, 2006

I, Michael A. Royer, for Professional Testing (EMI), Inc., being familiar with the FCC rules and test procedures have reviewed the test setup, measured data and this report. I believe them to be true and accurate.

The **In Dispenser Module (IDM)** was tested to and found to be in compliance with FCC Part 15 Subpart C for an Intentional Radiator.

The highest emissions generated by the above equipment are listed below:

| **Fundamental** | Frequency (MHz) | Level (dB µV/m) at 30 m | Limit (dB µV/m) at 30 m | Limit (µV/m) at 30 m | Margin (dB) |
|---|---|---|---|---|---|
| Paragraph 15.225(a) | 13.56 (peak) | 46.2 | 84 | 15,848 | -37.8 |

| **Other Emissions** | Frequency (MHz) | Level (dB µV/m) | Limit (dB µV/m) | Margin (dB) |
|---|---|---|---|---|
| Harmonics | 40.68 (peak) | 36.9 | 40.0 | -3.1 |
| Spurious (@ 10 m) | 474.60 (peak) | 41.2 | 46.0 | -4.8 |
| Conducted | 13.5787 (avg) | 47.1 | 50.0 | -2.9 |

Michael A. Royer, BSEE, NCE
EMC Department Manager

This report has been reviewed and accepted by the applicant. The undersigned is responsible for ensuring that the equipment named above will continue to comply with the FCC rules.

# 1.0 EUT Description

The Equipment Under Test (EUT) is a RFID tag reader module and is intended for sale under the provisions of modular approval for the use of the manufacturer. The EUT application is for the reading of point-of-sale electronic funds credit/debit information tags for fueling/gas station pumps.

The EUT is embedded into one of two circuit boards, a larger assembly powered from 24 VAC taken from a small transformer powered by the AC mains. The other circuit board is the EUT antenna. The larger assembly provides DC power to the EUT and reads any available RFID data.

The system tested consisted of the following:

| Manufacturer | Model | FCC ID Number |
|---|---|---|
| Latest Advanced Digital Solutions, Inc. | In Dispenser Module | TZPIDM |

## 1.1 Applicable Rule Parts

| Guidelines | FCC Rules, Part 15 |
|---|---|
| Transmitter Characteristics | 15.225 |
| Spurious Radiated Power* | 15.225, 15.209 |
| Powerline Conducted Limit | 15.207 |
| Antenna Requirement | 15.203 |

* Exempt from the 13.36 MHz to 14.41 MHz restricted band per FCC 15.205(d) paragraph (7).

## 1.2 EUT Operation

The EUT was operated in continuous transmit mode at maximum power to measure fundamental, harmonics, and spurious radiation.

As an RFID device, the transmit mode is continually engaged and data reception is only accomplished by detecting the loading induced on the transmitted field by a RFID tag.

## 1.3 Test Facility

Conducted emissions measurements on the mains terminals were performed at Professional Testing, located in Round Rock, Texas.

Professional Testing (EMI), Inc. (PTI), follows the guidelines of NIST for all uncertainty calculations, estimates and expressions thereof for EMC testing. PTI's policy for EMC Measurement Uncertainty is provided in Appendix C.

# 2.0 Powerline Conducted Emissions

## 2.1 Test Procedure

The EUT was configured and operated in a manner consistent with typical applications. The EUT power cord in excess of one meter was folded back and forth forming a bundle 30 to 40 cm long in the approximate center of the cable. Power supply cords for the peripheral equipment were powered from an auxiliary LISN. Excess interface cable lengths were separately bundled in a non-inductive arrangement at the approximate center of the cable with the bundle 30 to 40 centimeters in length. The conducted emissions were maximized, by varying the operating states and configuration of the EUT.

The tests were performed in a 12' x 16' RayProof modular shielded room. The EUT was placed on a non-metallic table 0.4 meters from a vertical metal reference plane and 0.8 meters from a horizontal metal reference plane.

As an intentional transmitter operating below 30 MHz, emissions were measured with the antenna attached and driven as designed. Since fundamental emissions below 30 MHz usually exceed the conducted limits, the conducted emissions are then measured again with a resistive load substituted for the antenna. The measurements of both test conditions are reported.

## 2.2 Test Criteria

The FCC Part 15 Class B conduction limits are given below.

| Frequency (MHz) | Conducted Limits (dBµV) | |
|---|---|---|
| | Average | Quasi-Peak |
| 0.15 – .50 | 66-56* | 56 – 46* |
| .50 - 5 | 56 | 46 |
| 5 – 30 | 60 | 50 |

The tighter limit shall apply at the edge between two frequency bands.
*Decreases with the logarithm of the frequency.

## 2.3 Test Results

The conducted emissions data is included as Appendix B. The conducted emissions generated by the EUT as measured on the mains terminals with the substituted resistive load were found to satisfy the test criteria.

### 2.4 Test Equipment

| Asset # | Manufacturer | Model # | Description | Calibration Due |
|---|---|---|---|---|
| C025 | Belden | RG223 | Coaxial Cable | Calibrate Before Use |
| 0572 | PTI | CISPR16 | High Pass Filter | September 16, 2006 |
| 0759 | Solar | 8012 | LISN | October 5, 2006 |
| 0027 | EMCO | 3825/2 | Auxiliary LISN | July 11, 2006 |
| 0045 | HP | 85662A | Spectrum Analyzer Display | Not Required |
| 0237 | HP | 8568B | Spectrum Analyzer | December 14, 2006 |
| 0239 | HP | 85650A | Quasi-peak Adapter | December 14, 2006 |
| 0990 | HP | 85685A | RF Preselector | December 14, 2006 |
| 0474 | PTI | 3dB | Limiter | September 16, 2006 |
| 0081 | Elgar | 1751SL | Variable AC Power Source | Calibrate Before Use |

## 3.0 Carrier Field Strength

### 3.1 Test Procedure

Tests of the fundamental for the device were performed to determine the worst case polarization of the devices. The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable which allows 360 degree rotation. For measurements of the fundamental signal, a measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT. The radiated emissions were maximized by rotating the EUT. Where loops antennas are employed below 30 MHz, the antenna is fixed at a base height of 1 meter, though is rotated 90 degrees for measuring emissions in the face-on and edge-on orientations.

A drawing showing the test setup is given as Figure 1.

### 3.2 Test Criteria

The table below shows the relevant FCC radiated limits and measurement distance for the EUT. The actual measurement distance and adjusted limit is determined and applied.

| Fundamental Frequency MHz | Fundamental Field Strength at Distance | |
|---|---|---|
| | FCC Section 15.225(a) µV/m at 30 m | As Measured dB µV/m at 30 m |
| 13.56 | 15,848 | 84 |

**Note: The fundamental limit is expressed in peak field strength.**

### 3.3 Test Results

The radiated test data for the fundamental is included in Appendix B. The radiated emissions satisfy the test criteria.

### 3.4 Test Equipment

| Asset # | Manufacturer | Model # | Description | Calibration Due |
|---|---|---|---|---|
| C005 | None | None | Underground Coaxial Cable | December 8, 2006 |
| 0950 | HP | 8566B | Spectrum Analyzer | April 24, 2006 |
| 0949 | HP | 8566B | Spectrum Analyzer Display | April 24, 2006 |
| 0275 | HP | 85650A | Quasi-peak Adapter | April 24, 2006 |
| 0006 | EMCO | 6502 | Active Loop Antenna | November 9, 2006 |

## 4.0 Spurious and Harmonic Radiated Emissions

### 4.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable which allows 360 degree rotation. For measurements of the spurious/harmonic radiated emissions, a measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT. The radiated emissions were maximized by rotating the EUT. Where loops antennas are employed below 30 MHz, the antenna is fixed at a base height of 1 meter, though is rotated 90 degrees for measuring emissions in the face-on and edge-on orientations.

A Spectrum Analyzer with quasi-peak detection was used to find the maximums of the radiated emissions during the variability testing. A drawing showing the test setup is given as Figure 2.

Note that the 2$^{nd}$ harmonic is measured with the same test equipment as the fundamental as this harmonic is below 30 MHz.

### 4.2 Test Criteria

The FCC Class B radiated limits are given below.

| Frequency MHz | Test Distance (Meters) | Field Strength (uV/m) | (dBµV/m) |
|---|---|---|---|
| 1.705 to 30 | 30 | 30 | 29.5 |
| 30 to 88 | 3 | 100 | 40.0 |
| 88 to 216 | 3 | 150 | 43.5 |
| 216 to 960 | 3 | 200 | 46.0 |
| Above 960 | 3 | 500 | 54.0 |

The lower limit shall apply at the transition frequency.

### 4.3 Test Results

Photographs of the EUT configuration during the radiated testing program are included in Appendix C. The radiated test data is included as Appendix B. The emissions identified from the EUT were maximized at each frequency. The radiated emissions generated by EUT were below the FCC Class B maximum criteria.

### 4.4 Test Equipment

| Asset # | Manufacturer | Model # | Description | Calibration Due |
|---|---|---|---|---|
| C005 | None | None | Underground Coaxial Cable | December 8, 2006 |
| 0754 | Compliance Design | B100 | Biconical Antenna | June 3, 2006 |
| 0238 | HP | 85685A | RF Preselector | April 24, 2006 |
| 0950 | HP | 8566B | Spectrum Analyzer | April 24, 2006 |
| 0949 | HP | 8566B | Spectrum Analyzer Display | April 24, 2006 |
| 0275 | HP | 85650A | Quasi-peak Adapter | April 24, 2006 |
| 0483 | HP | 8447D | RF Preamplifier | January 12, 2007 |
| 0755 | EMCO | 3146 | Log Periodic Dipole Array Antenna | June 8, 2006 |

## 5.0 Frequency Tolerance

### 5.1 Test Procedure

The EUT operating frequency is measured with a frequency counter for the following conditions:

1. At air temperatures of -20 º C to 50 º C with a nominal operating voltage, or if battery operated with a new battery.

2. At an air temperature of 20 º C over a primary supply voltage variation of 85% to 115% of nominal supply voltage.

### 5.2 Test Criteria

Carrier signal shall remain within +/- 0.01% (+/- 1.356 kHz).

### 5.3 Test Results

The frequency tolerance and mains power tolerance test data is included in Appendix B of this report. The EUT satisfies the frequency tolerance criteria.

### 5.4 Test Equipment

| Asset # | Manufacturer | Model # | Description | Calibration Due |
|---|---|---|---|---|
| 0410 | Hewlett Packard | 8591E | Spectrum Analyzer | October 18, 2006 |
| 0717 | EIP | 548A | Frequency Counter | Cal Before Use - WWV |
| 0881 | Thermotron | S-1.2C | Temperature Chamber | October 18, 2006 |

## 6.0 Emissions Mask

### 6.1 Test Procedure

Radiated emissions are measured in the RFID allocated band as stipulated in the relevant FCC rules. The emission mask is determined from the FCC rules and sections applicable to the EUT.

### 6.2 Test Criteria

Per FCC Rules, Section 15.225 Operation within the band 13.110 – 14.010 MHz. The following limits apply forming an emission mask around the carrier.

| **Frequency (MHz)** | 13.110-13.410 | 13.410-13.553 | 13.553-13.567 | 13.567-13.710 | 13.710-14.010 |
|---|---|---|---|---|---|
| **Limit Level (µV/m)** | 106 | 334 | 15,848 | 334 | 106 |

The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

### 6.3 Test Results

The highest emission (the fundamental at 13.56 MHz) was 4.3 dB below the 2nd highest limit range in the criteria cited above. Other spurious was 24 dB below the relevant limit range. No additional measurement was necessary to show compliance. The results are shown in Appendix B. The EUT emissions met the emission mask criteria.

## 7.0 Occupied Bandwidth

### 7.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the floor. The occupied bandwidth was based on a 20 dB criteria (20 dB down either side of the emission from the peak emission).

### 7.2 Test Criteria

Measure the 20 dB bandwidth to verify emissions are within the allocated band by comparing bandwidth to the allocated band within the edges of 13.110 MHz to 14.010 MHz.

### 7.3 Test Results

The occupied bandwidth and band edge test data is included in Appendix B of this report. The EUT satisfies the criteria.

### 7.4 Test Equipment

| Asset # | Manufacturer | Model # | Description | Calibration Due |
|---|---|---|---|---|
| C005 | None | None | Underground Coaxial Cable | December 8, 2006 |
| 0950 | HP | 8566B | Spectrum Analyzer | April 24, 2006 |
| 0949 | HP | 8566B | Spectrum Analyzer Display | April 24, 2006 |
| 0275 | HP | 85650A | Quasi-peak Adapter | April 24, 2006 |
| 0006 | EMCO | 6502 | Active Loop Antenna | November 9, 2006 |

## 8.0 Modifications

None.

# Appendix A Test Setup Figures

**FIGURE 1: Conducted Emissions Mains Terminal Measurements**

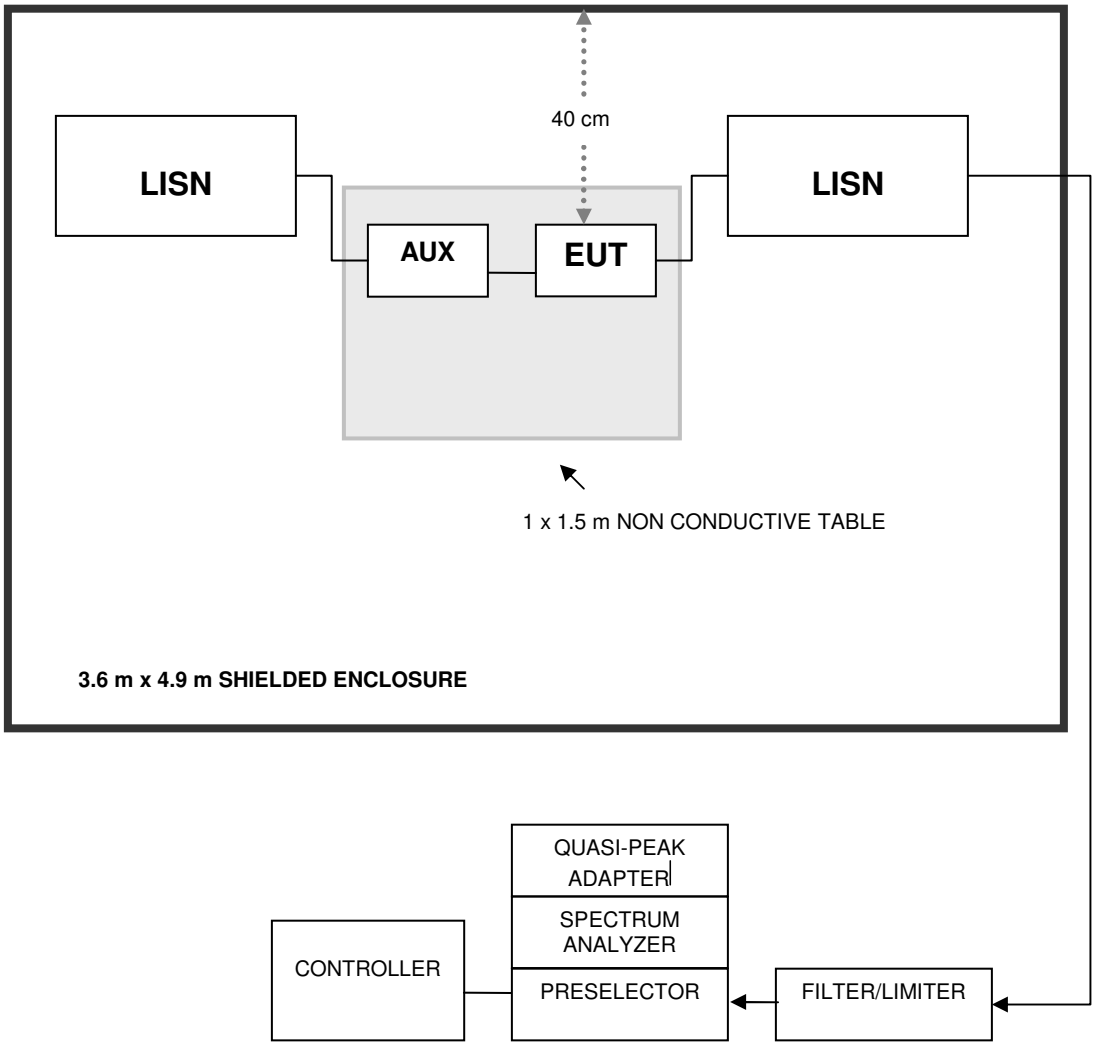
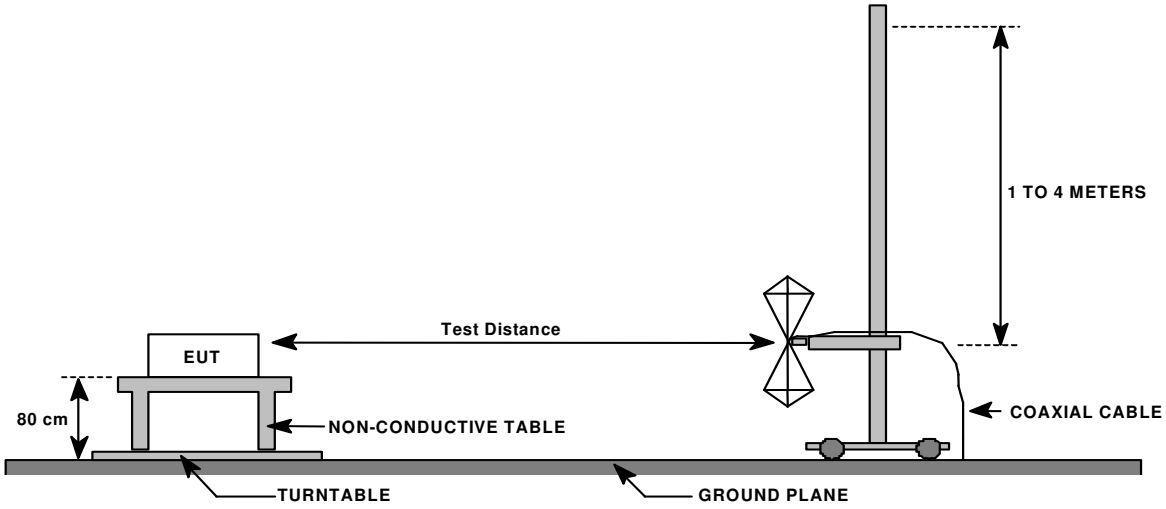


**FIGURE 2: Radiated Emissions Test Setup**



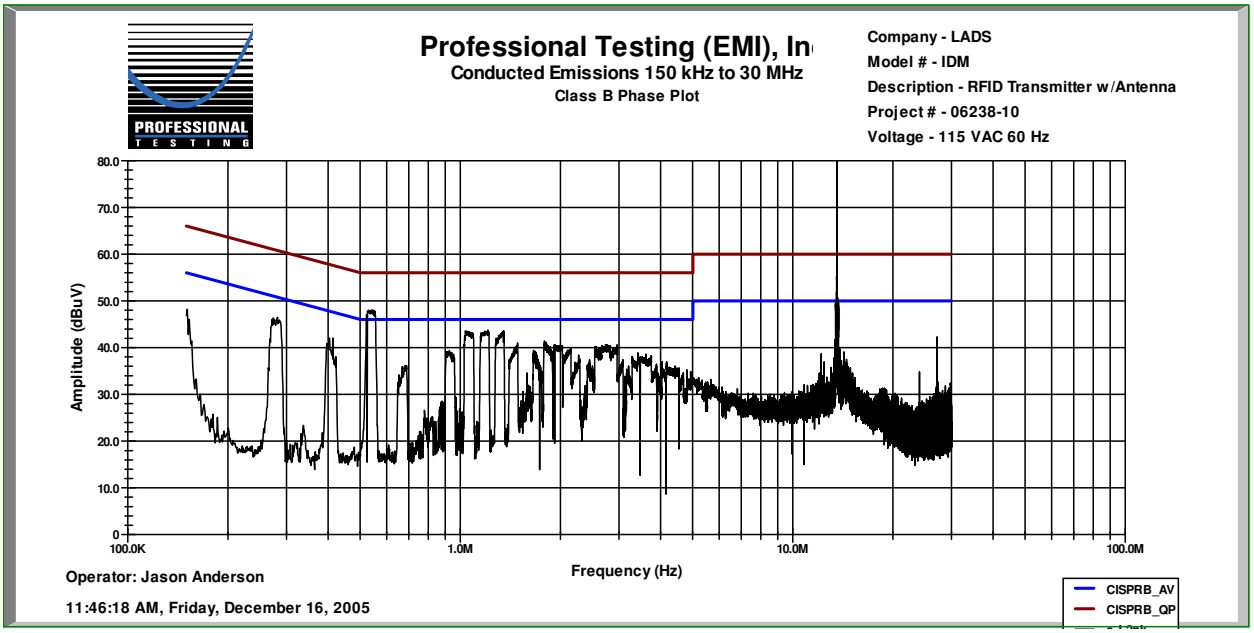
# Appendix B Test Results

## Conducted Emissions Data Sheet

| PROJECT # | DATE | CLASS | LINE | POWER SOURCE |
|---|---|---|---|---|
| 06238-10 | Dec 16, 2005 | FCC B | PHASE | AC 120/60 |

| COMMENT | With antenna, see later section for same test with load resistor substitution. |
|---|---|

| Frequency Reading (MHz) | Quasi-peak Reading (dBµV) | Average Reading (dBµV) | Quasi-peak Limit (dBµV) | Quasi-peak Margin (dB) | Average Limit (dBµV) | Average Margin (dB) |
|---|---|---|---|---|---|---|
| 0.152171 | 46.5 | 38.5 | 65.9 | -19.5 | 55.9 | -17.5 |
| 0.27748 | 44.7 | 39.8 | 62.4 | -17.7 | 52.4 | -12.6 |
| 0.52445 | 46.3 | 36.1 | 56.0 | -9.7 | 46.0 | -9.9 |
| 0.53655 | 46.2 | 36.1 | 56.0 | -9.8 | 46.0 | -9.9 |
| 1.34827 | 41.1 | 24.2 | 56.0 | -14.9 | 46.0 | -21.8 |
| 12.1588 | 36.2 | 30.3 | 60.0 | -23.8 | 50.0 | -19.7 |
| 13.5787 | 47.9 | 47.1 | 60.0 | -12.1 | 50.0 | -2.9 |
| 14.2637 | 35.2 | 28.9 | 60.0 | -24.8 | 50.0 | -21.1 |
| 14.3478 | 33.9 | 29.0 | 60.0 | -26.1 | 50.0 | -21.0 |
| 14.5185 | 34.1 | 27.9 | 60.0 | -25.9 | 50.0 | -22.1 |




**Graphical data is for overview only. Plotted data is peak measurement.**

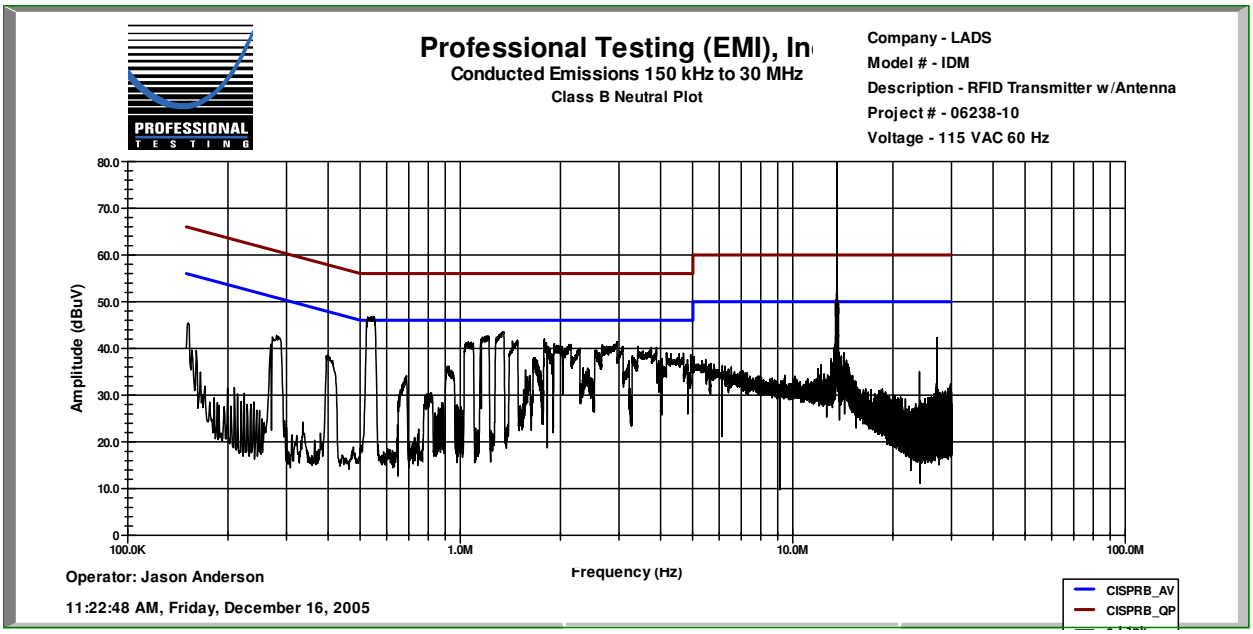
TEST ENGINEER: JASON ANDERSON

## Conducted Emissions Data Sheet

| PROJECT # | DATE | CLASS | LINE | POWER SOURCE |
|---|---|---|---|---|
| 06238-10 | Dec 16, 2005 | FCC B | NEUTRAL | AC 120/60 |

| COMMENT | With antenna, see later section for same test with load resistor substitution. |
|---|---|

| Frequency Reading (MHz) | Quasi-peak Reading (dBµV) | Average Reading (dBµV) | Quasi-peak Limit (dBµV) | Quasi-peak Margin (dB) | Average Limit (dBµV) | Average Margin (dB) |
|---|---|---|---|---|---|---|
| 0.150253 | 43.6 | 32.3 | 66.0 | -22.4 | 56.0 | -23.7 |
| 0.28488 | 41.6 | 36.6 | 62.1 | -20.6 | 52.1 | -15.6 |
| 0.54426 | 45.0 | 34.7 | 56.0 | -11.0 | 46.0 | -11.3 |
| 1.20981 | 40.3 | 24.3 | 56.0 | -15.7 | 46.0 | -21.7 |
| 1.34533 | 41.2 | 24.5 | 56.0 | -14.8 | 46.0 | -21.5 |
| 13.5777 | 80.6 | 79.9 | 60.0 | 20.6 | 50.0 | 29.9 |
| 13.5778 | 80.6 | 79.9 | 60.0 | 20.6 | 50.0 | 29.9 |
| 13.5778 | 80.6 | 79.9 | 60.0 | 20.6 | 50.0 | 29.9 |
| 13.5779 | 80.6 | 80.1 | 60.0 | 20.6 | 50.0 | 30.1 |




**Graphical data is for overview only. Plotted data is peak measurement.**

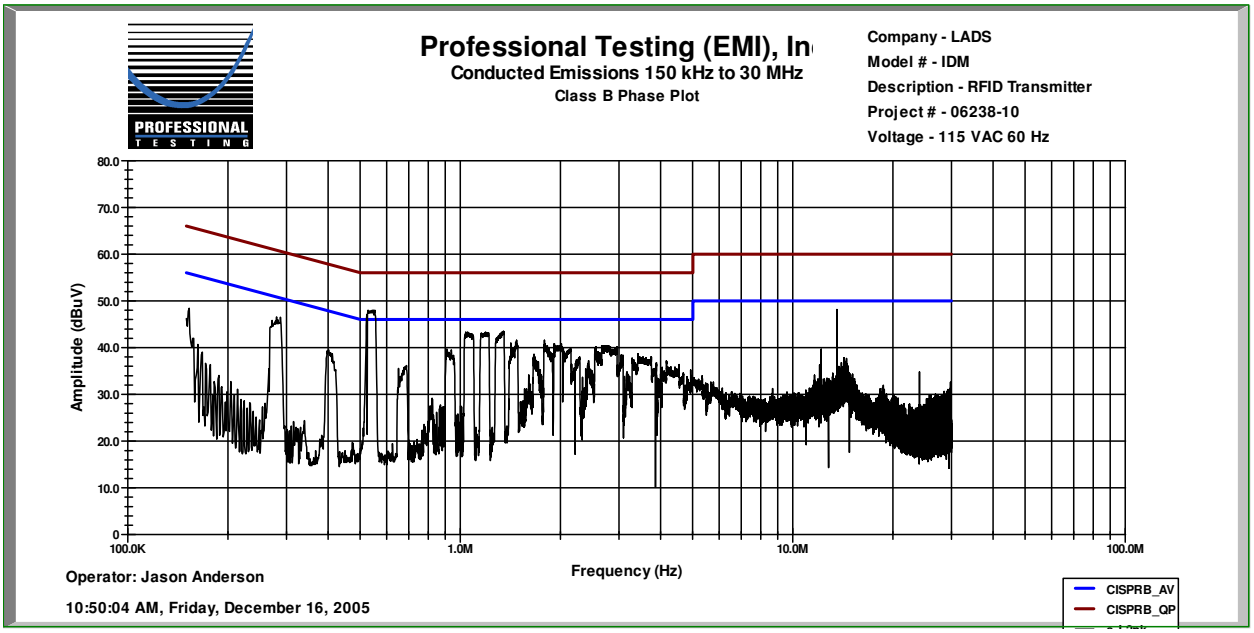
TEST ENGINEER: JASON ANDERSON

## Conducted Emissions Data Sheet

| PROJECT # | DATE | CLASS | LINE | POWER SOURCE |
|---|---|---|---|---|
| 06238-10 | Dec 16, 2005 | FCC B | PHASE | AC 120/60 |

| COMMENT | With load substituted. |
|---|---|

| Frequency Reading (MHz) | Quasi-peak Reading (dBµV) | Average Reading (dBµV) | Quasi-peak Limit (dBµV) | Quasi-peak Margin (dB) | Average Limit (dBµV) | Average Margin (dB) |
|---|---|---|---|---|---|---|
| 0.152171 | 46.5 | 38.5 | 65.9 | -19.5 | 55.9 | -17.5 |
| 0.27748 | 44.7 | 39.8 | 62.4 | -17.7 | 52.4 | -12.6 |
| 0.52445 | 46.3 | 36.1 | 56.0 | -9.7 | 46.0 | -9.9 |
| 0.53655 | 46.2 | 36.1 | 56.0 | -9.8 | 46.0 | -9.9 |
| 1.34827 | 41.1 | 24.2 | 56.0 | -14.9 | 46.0 | -21.8 |
| 12.1588 | 36.2 | 30.3 | 60.0 | -23.8 | 50.0 | -19.7 |
| 13.5787 | 47.9 | 47.1 | 60.0 | -12.1 | 50.0 | -2.9 |
| 14.2637 | 35.2 | 28.9 | 60.0 | -24.8 | 50.0 | -21.1 |
| 14.3478 | 33.9 | 29.0 | 60.0 | -26.1 | 50.0 | -21.0 |
| 14.5185 | 34.1 | 27.9 | 60.0 | -25.9 | 50.0 | -22.1 |




**Graphical data is for overview only. Plotted data is peak measurement.**

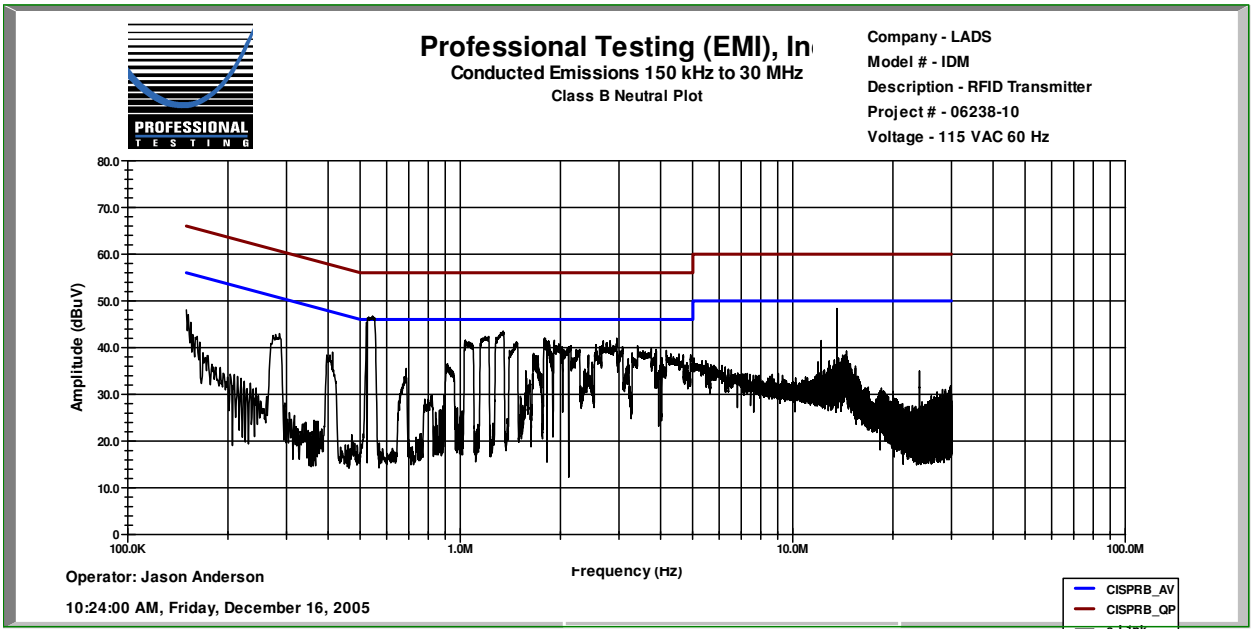
TEST ENGINEER: JASON ANDERSON

## Conducted Emissions Data Sheet

| PROJECT # | DATE | CLASS | LINE | POWER SOURCE |
|---|---|---|---|---|
| 06238-10 | Dec 16, 2005 | FCC B | NEUTRAL | AC 120/60 |

| COMMENT | With load substituted. |
|---|---|

| Frequency Reading (MHz) | Quasi-peak Reading (dBµV) | Average Reading (dBµV) | Quasi-peak Limit (dBµV) | Quasi-peak Margin (dB) | Average Limit (dBµV) | Average Margin (dB) |
|---|---|---|---|---|---|---|
| 0.150863 | 44.6 | 32.7 | 66.0 | -21.3 | 56.0 | -23.3 |
| 0.2831 | 41.7 | 36.6 | 62.2 | -20.5 | 52.2 | -15.6 |
| 0.53164 | 45.0 | 34.6 | 56.0 | -11.0 | 46.0 | -11.4 |
| 0.53613 | 45.0 | 34.8 | 56.0 | -11.0 | 46.0 | -11.2 |
| 1.34579 | 41.2 | 24.5 | 56.0 | -14.8 | 46.0 | -21.5 |
| 12.1657 | 36.6 | 30.3 | 60.0 | -23.4 | 50.0 | -19.7 |
| 13.5762 | 48.0 | 47.1 | 60.0 | -12.0 | 50.0 | -2.9 |
| 14.0855 | 31.8 | 26.7 | 60.0 | -28.2 | 50.0 | -23.3 |
| 14.3451 | 32.3 | 27.2 | 60.0 | -27.7 | 50.0 | -22.8 |
| 14.5151 | 34.1 | 27.6 | 60.0 | -25.9 | 50.0 | -22.4 |




**Graphical data is for overview only. Plotted data is peak measurement.**

TEST ENGINEER: JASON ANDERSON

## Fundamental Radiated Emissions Data Sheet
## Transmit Mode
## $f_o$ = 13.56 MHz Carrier

| PROJECT # | DATE | CLASS | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 06238-10 | Jan 26, 2006 | FCC B | 3 m | Loop | CISPR 9 kHz | 1 MHz | Peak |

| COMMENT | Transmit mode (RFID). |
|---|---|

ANTENNA ORIENTATION: **Face On**

| Frequency (MHz) | EUT Direction (degrees) | Antenna Elevation (Meters) | Recorded Level (dB µV) | Amplifier Gain (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Distance Factor (dB) | Corrected Level (dB µV/m) | Limit (dB µV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 13.56 | 0 | 1 | 77.4 | 0.0 | 7.6 | 1.2 | -40.0 | 46.2 | 84 | -37.8 |

ANTENNA ORIENTATION: **Edge On**

| Frequency (MHz) | EUT Direction (degrees) | Antenna Elevation (Meters) | Recorded Level (dB µV) | Amplifier Gain (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Distance Factor (dB) | Corrected Level (dB µV/m) | Limit (dB µV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 13.56 | 0 | 1 | 72 | 0.0 | 7.6 | 1.2 | -40.0 | 40.8 | 84 | -43.2 |

TEST ENGINEER: JASON ANDERSON

## Transmit Mode Spurious & Harmonics
## Radiated Emissions Data Sheet
## 30 MHz ≤ f ≤ 1000 MHz

| PROJECT # | DATE | CLASS | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 06238-10 | Jan 6, 2006 | CISPR A | 3 m | Bicon \| Log | CISPR 120 kHz | 1 MHz | Peak |

| COMMENT | Transmit mode (RFID). |
|---|---|

ANTENNA POLARIZATION: Horizontal

| Freq. (MHz) | EUT Dir (Deg.) | Antenna Elev. (Meters) | Recorded Level (dBµV) | Amplifier Gain (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Corrected Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 162.73 | 0 | 2 | 44.9 | 26.8 | 13.7 | 3.5 | 35.3 | 43.5 | -8.2 |
| 189.84 | 0 | 2 | 44.4 | 26.8 | 17.0 | 3.8 | 38.4 | 43.5 | -5.1 |
| 216.96 | 0 | 1.5 | 47.1 | 26.8 | 11.4 | 4.1 | 35.8 | 46 | -10.2 |
| 230.52 | 0 | 1.5 | 49.4 | 26.9 | 11.5 | 4.3 | 38.3 | 46 | -7.7 |
| 271.20 | 0 | 1.5 | 44.2 | 26.9 | 13.8 | 4.7 | 35.8 | 46 | -10.2 |
| 311.88 | 0 | 1.5 | 43.2 | 27.1 | 15.3 | 5.1 | 36.5 | 46 | -9.5 |
| 339.00 | 0 | 1.5 | 44.2 | 27.2 | 14.9 | 5.4 | 37.2 | 46 | -8.8 |
| 352.56 | 0 | 1.5 | 44 | 27.3 | 14.8 | 5.6 | 37.1 | 46 | -8.9 |
| 366.12 | 0 | 1.5 | 45.6 | 27.2 | 15.1 | 6.3 | 39.7 | 46 | -6.3 |
| 393.24 | 0 | 1.5 | 45 | 27.3 | 15.7 | 6.1 | 39.5 | 46 | -6.5 |
| 420.36 | 0 | 1.5 | 43.9 | 27.5 | 16.0 | 6.1 | 38.5 | 46 | -7.5 |
| 447.48 | 0 | 1.5 | 43.6 | 27.3 | 16.5 | 6.3 | 39.2 | 46 | -6.8 |

ANTENNA POLARIZATION: Vertical

| Freq. (MHz) | EUT Dir (Deg.) | Antenna Elev. (Meters) | Recorded Level (dBµV) | Amplifier Gain (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Corrected Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 40.68 | 0 | 1.5 | 50.3 | 26.5 | 11.5 | 1.6 | 36.9 | 40 | -3.1 |
| 54.24 | 0 | 1.5 | 46.1 | 26.6 | 10.3 | 1.8 | 31.6 | 40 | -8.4 |
| 67.80 | 0 | 1.5 | 47.8 | 26.7 | 7.1 | 2.9 | 31.1 | 40 | -8.9 |
| 162.73 | 0 | 1.5 | 42.9 | 26.8 | 13.7 | 3.5 | 33.3 | 43.5 | -10.2 |
| 189.84 | 0 | 1.5 | 40.5 | 26.8 | 17.0 | 3.8 | 34.5 | 43.5 | -9.0 |
| 366.12 | 0 | 1.5 | 43.6 | 27.2 | 15.1 | 6.3 | 37.7 | 46 | -8.3 |
| 393.24 | 0 | 1.5 | 43.6 | 27.3 | 15.7 | 6.1 | 38.1 | 46 | -7.9 |
| 420.36 | 0 | 1.5 | 44.3 | 27.5 | 16.0 | 6.1 | 38.9 | 46 | -7.1 |
| 447.48 | 0 | 1.5 | 44.7 | 27.3 | 16.5 | 6.3 | 40.3 | 46 | -5.7 |
| 474.60 | 0 | 1.5 | 45.1 | 27.6 | 17.0 | 6.6 | 41.2 | 46 | -4.8 |
| 555.96 | 0 | 1.5 | 39.9 | 27.2 | 18.2 | 7.3 | 38.2 | 46 | -7.8 |

TEST ENGINEER: JASON ANDERSON

**Radiated Emissions Data Sheet**
**Transmit Mode**
**Harmonics (2nd Only) and Spurious Emissions**
**13.56 MHz ($f_o$) < f ≤ 30 MHz**

| PROJECT # | DATE | CLASS | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 06238-10 | Jan 26, 2006 | FCC B | 3 m | Loop | CISPR 9 kHz | 1 MHz | Peak |

| COMMENT | Transmit mode (RFID). |
|---|---|

ANTENNA ORIENTATION: **Face On**

| Frequency (MHz) | EUT Direction (degrees) | Antenna Elevation (Meters) | Recorded Level (dB µV) | Amplifier Gain (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Distance Factor (dB) | Corrected Level (dB µV/m) | Limit (dB µV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 27.12 | 0 | 1 | 12.3 | 0.0 | 7.9 | 1.5 | -40.0 | -18.3 | 29.5 | -47.8 |

ANTENNA ORIENTATION: **Edge On**

| Frequency (MHz) | EUT Direction (degrees) | Antenna Elevation (Meters) | Recorded Level (dB µV) | Amplifier Gain (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Distance Factor (dB) | Corrected Level (dB µV/m) | Limit (dB µV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 27.12 | 0 | 1 | 12.3 | 0.0 | 7.9 | 1.5 | -40.0 | -18.3 | 29.5 | -47.8 |

TEST ENGINEER: JASON ANDERSON

## Frequency Tolerance Datasheet

**Test Date:** Jan 26, 2006

| Temperature Frequency Stability | | |
|---|---|---|
| **Temperature ℃** | **Frequency MHz** | **Error Hz** |
| -20 | 13.559786 | -214 |
| -10 | 13.559817 | -183 |
| 0 | 13.559823 | -177 |
| 10 | 13.559809 | -191 |
| 20 | 13.559784 | -216 |
| 30 | 13.559755 | -245 |
| 40 | 13.559732 | -268 |
| 50 | 13.559720 | -280 |

| **Supply Voltage Frequency Stability** | |
|---|---|
| **Supply Voltage** | **Frequency (MHz)** |
| 115 VAC | 13.559770 |
| 115% | No change |
| 85% | No change |

TEST ENGINEER: JASON ANDERSON

## Emission Mask Datasheet

Test Date: Jan 26, 2006

The nearest spur (at approximately 13.9 MHz) in the mask range was found to be in the 13.710 to 14.010 MHz mask span. (See Band Edge plots; the horizontal scale in the band edge plots are 0.09 MHz/division.)

This spur was measured to be more than 30 dB down from the carrier at a level of 46.2 dB µV/m.

Referencing the measured maximum of the fundamental at 13.56 MHz, the spur level calculates to be: 46.2 – 30 = 16.2 dB µV/m

The applicable mask limit for this frequency is: 106 µV/m or 40.5 dB µV/m

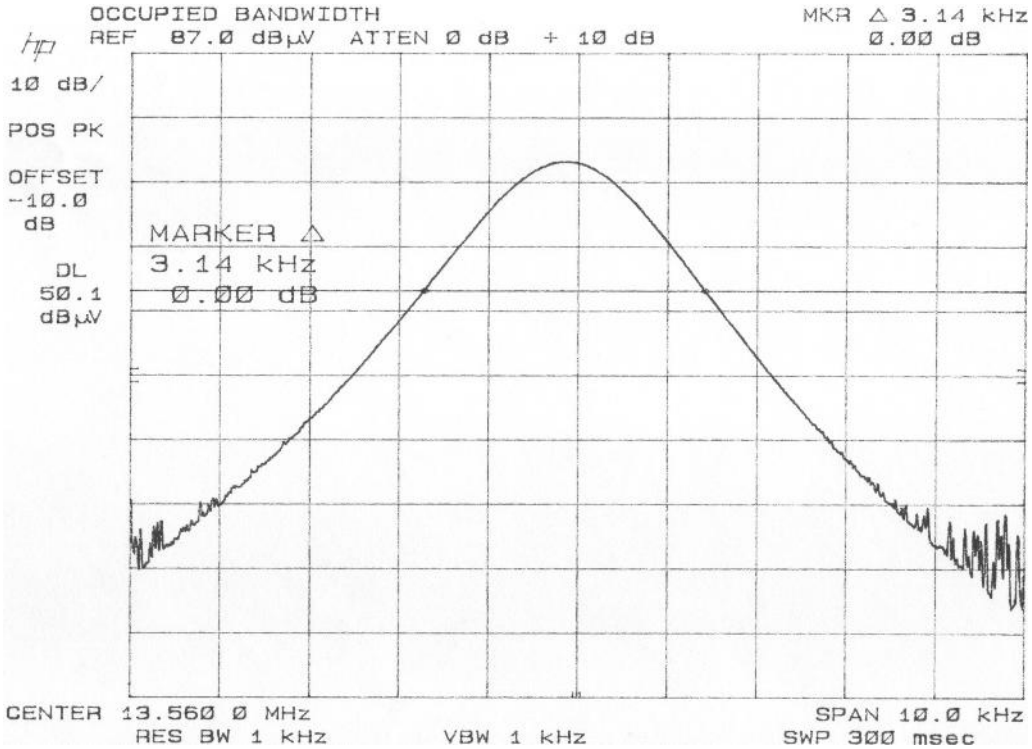
This yields a margin for this mask level of -24.3 dB.

The EUT satisfies the mask criteria. No additional measurements required.

TEST ENGINEER: JASON ANDERSON

## Occupied Bandwidth Datasheet

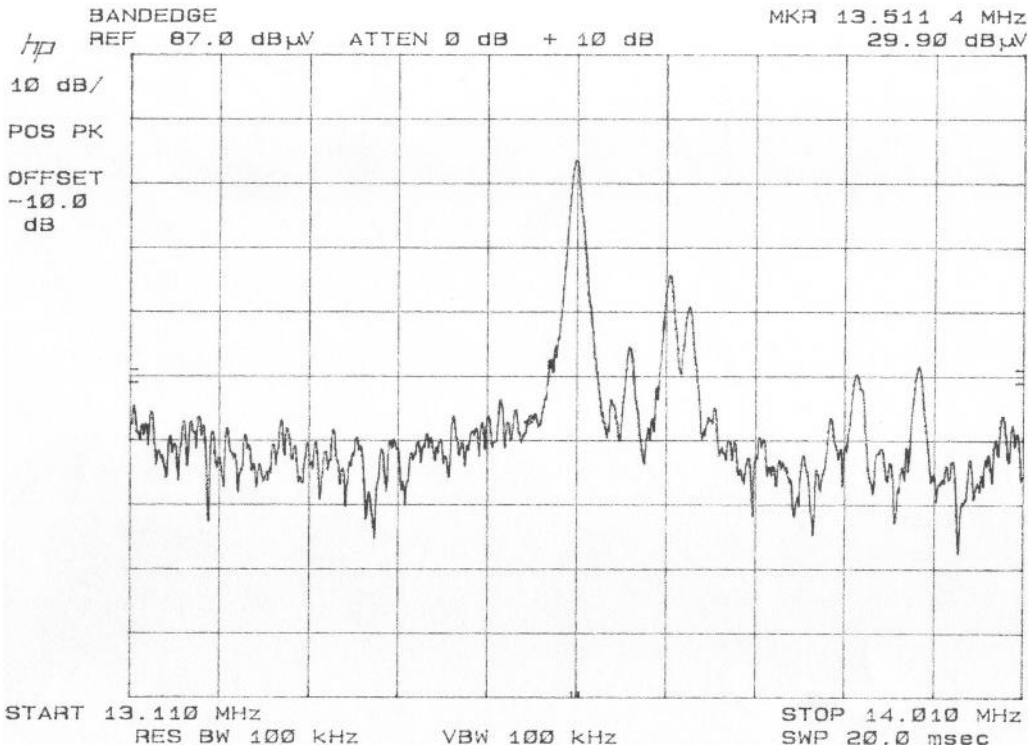
Test Date: Jan 26, 2005

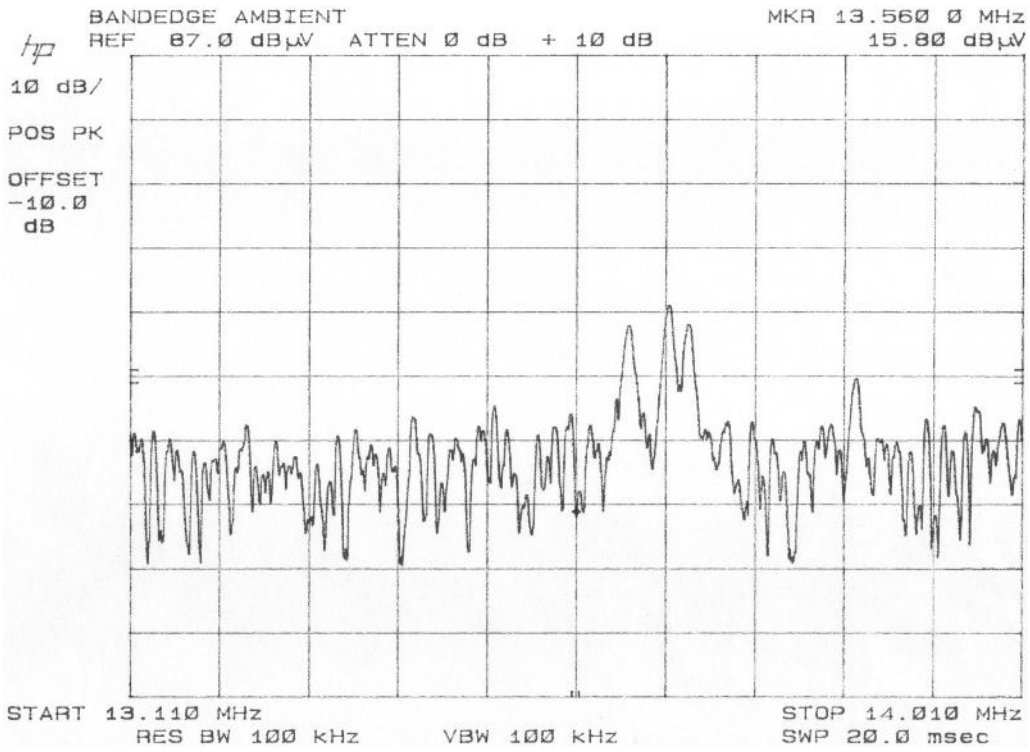


## Band Edge Datasheet

Test Date: Jan 26, 2005

Note that horizontal divisions in the following plots are 0.09 MHz each.




TEST ENGINEER: JASON ANDERSON

# Appendix C Policy, Rationale and Evaluation of EMC Measurement Uncertainty

**Professional Testing (EMI) Inc. (PTI) Policy, Rationale and Evaluation of EMC Measurement Uncertainty**

All uncertainty calculations, estimates and expressions thereof shall be in accordance with NIST policy stated in Appendix E to NIST Technical Communications Program, Subchapter 4.09 of the Administrative Manual, as reproduced in Appendix C of NIST Technical Note (TN) 1297, 1994 Edition [1]1. The NIST policy is based on ISO Guide to the Expression of Uncertainty in Measurement [2] (herein after called the Guide), which shall take precedence in the event of disputes. The Guide is explained in TN 1297. Other notable explanations for the Guide are NAMAS Publications NIS 80 [3] and NIS 81 [4]; the latter being specifically for EMC measurements, and the easiest to understand. Since PTI operates in accordance with NIST (NVLAP) Handbook 150-11 [5], all instrumentation having an effect on the accuracy or validity of tests shall be periodically calibrated or verified traceable to national standards by a competent calibration laboratory. The certificates of calibration or verification on this instrumentation shall include estimates of uncertainty as required by NIST Handbook 150-11.

1. Rationale and Summary of Expanded Uncertainty.

Each piece of instrumentation at PTI that is used in making measurements for determining conformance to a standard (or limit), shall be assessed to evaluate its contribution to the overall uncertainty of the measurement in which it is used. The assessment of each item will be based on either a type A evaluation or a type B evaluation. Most of the evaluations will be type B, since they will be based on the manufacture's statements or specifications of the calibration tolerances or uncertainty will be stated along with a brief rationale for the type of evaluation and the resulting state uncertainties.

The individual uncertainties included in the combined standard uncertainty for a specific test result will depend on the configuration in which the item of instrumentation is used. The combination will always be based on the law of propagation of uncertainty discussed in TN 1297, NIS 81, and the Guide. Any systematic effects will be accommodated by including their uncertainties, in the calculation of the combined standard uncertainty; except that if the direction and amount of the systematic effect cannot be determined and separated from its uncertainty, the whole effect will be treated as uncertainty and combined along with the other elements of the test setup.

Type A evaluations of standard uncertainty will usually be based on calculating the standard deviation of the mean of a series of independent observations, but may be based on a least-squares curve fit or the analysis of variance for unusual situations. Type B evaluations of standard uncertainty will usually be based on manufacturer's specifications, data provided in calibration reports, and experience. The type of probability distribution used (normal, rectangular, a-priori, or u-shaped) will be stated for each Type B evaluation.

[1] Numbers in square brackets identify documents listed in the reference section.

In the evaluation of the uncertainty of each type of measurement, the uncertainty caused by the operator will be estimated. One notable operator contribution to measurement uncertainty is the manipulation of cables to maximize the measured values of radiated emissions. The operator contribution to measurement uncertainty is evaluated by having several operators independently repeat the same test. This results in a Type A evaluation of operator-contributed measurement uncertainty.

A summary of the expanded uncertainties of PTI measurements if shown is Table 1. These are the worst-case uncertainties considering all operative influence factors.

Table 1-1
Summary of Measurement Uncertainties

| Type of Measurement | Frequency Range | Meas. Dist. | Expanded Uncertainty U, dB (k=2) |
|---|---|---|---|
| Conducted Emissions | 150 kHz to 30 MHz | N/A | 2.9 |
| Radiated Emissions, Site #1 | 30 to 200 MHz | 3 m | 4.7 |
| | | 10 m | 4.4 |
| | 200 to 1000 MHz | 3 m | 4.6 |
| | | 10 m | 4.0 |
| | 1 to 2.5 GHz | 1 m | 2.5 |
| | 2.5 to 12.5 GHz | 1 m | 3.6 |
| | 12.5 to 18 GHz | 1 m | 4.0 |
| Radiated Emissions, Site #2 | 30 to 200 MHz | 3 m | 3.5 |
| | | 10 m | 3.7 |
| | 200 to 500 MHz | 3 m | 3.5 |
| | | 10 m | 3.1 |
| | 500 to 1000 MHz | 3 m | 4.0 |
| | | 10 m | 3.9 |
| Radiated Emissions, Site #3 | 30 to 200 MHz | 3 m | 3.9 |
| | 200 to 500 MHz | 3 m | 4.0 |
| | 500 to 1000 MHz | 3 m | 4.3 |