PROFESSIONAL TESTING
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May 17, 2006

Phil Katselnik
Dresser Wayne
3814 Jarrett Way
Austin, TX 78728

Dear Mr. Katselnik:

Enclosed is the Electromagnetic Compatibility Test Report for Dresser Wayne, Ovation. This report covers two variants of the bill acceptor subassembly.

This report can be utilized to demonstrate compliance with FCC Part 15, Class B on the part of the RFID transmitter. The entire host fuel delivery system meets FCC Class A.

If you have any questions, please contact me.

Sincerely,

Michael A. Royer

Michael A. Royer
EMC Department Manager

Enclosure

Projects: 06255-10, 06207-10

Dresser Wayne
Ovation

Electromagnetic Compatibility Test Report

Prepared for:

Dresser Wayne
3814 Jarrett Way
Austin, TX 78728

By

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

MAY 17, 2006

Reviewed by	Written by
Michael Royer EMC Department Manager	Eric Lifsey EMC Engineer

TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF APPENDICES

PROFESSIONAL TESTING

Certificate Of Compliance

Applicant: Dresser Wayne

Applicant's Address: 3814 Jarrett Way
Austin, TX 78728

Project Number: PTI 06255-10, PTI 06207-10

Test Dates: December 1 - December 6, 2005

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

The **Dresser Wayne, Ovation** 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)	37.5	84	15,848	-46.5

Other	Frequency (MHz)	Level (dB µV/m)	Limit (dB µV/m)	Margin (dB)
Harmonics	108.48(peak)	27.7	43.5	-15.8
Spurious	122.9(peak)	41.9	43.5	-1.6
Conducted	0.585(avg)	45.9	46.0	-0.1

Michael A. Royer

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 and Industry Canada rules.

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1.0 EUT Description

The Equipment Under Test (EUT) is a RFID tag reader. The application is for the reading of point-of-sale electronic funds credit/debit information tags for fueling/gas station pumps. Two EUTs were tested (two versions of the bill acceptor subassembly) and the worse-case emissions for both are presented in this report. The RF sections of these devices are identical.

The EUT is composed of two circuit boards. One board is an etched loop antenna. The other board contains both a RFID reader and a magnetic stripe reader. Both boards are embedded into the fueling station pump cabinet near the credit card slot. Power for the EUT is supplied from the host via a dedicated DC power connection.

The system tested consisted of the following:

Manufacturer	Model	FCC ID Number	IC Identifier
Dresser Wayne	Ovation	ORF-OVATION	6363A-OVATION

1.1 Applicable Rule Parts

Guidelines	FCC Rules, Part 15	IC Rules	
		RSS-GEN Issue 1	RSS-210 Issue 6
Transmitter Characteristics	15.225	4.1, 4.2, 4.4-4.6, 4.9, 7.2.4	2.2-2.2, 2.5-2.7, Annex 2 A2.6
Spurious Radiated Power*	15.225, 15.209	4.2, 4.7, 7.2.2	2.2-2.2, 2.5-2.7, Annex 2 A2.6
Powerline Conducted Limit	15.207	4.2, 4.7	
Antenna Requirement	15.203	7.1, 7.1.4	

* 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. The EUT was tested installed into the main cabinet of a representative fuel dispenser.

As an RFID device, the transmitter operates continually and data reception is accomplished by detecting the loading induced on the transmitted field by the 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.

Worse-case emissions were selected from the two bill acceptor test configurations. Some ~500 to ~600 kHz failing emissions, per Class B, are demonstrated in additional conducted emission data from project 06235-10 (prior to having the EUT installed) as passing the Class A limits and not sourced or otherwise created by the EUT (the RFID module).

2.2 Test Criteria

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

Frequency (MHz)	Conducted Limits (dBuV)	
	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 10, 2005
0239	HP	85650A	Quasi-peak Adapter	December 10, 2005
0990	HP	85685A	RF Preselector	December 10, 2005
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, 2005
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 2nd 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)	(dBuV/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, 2005
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 ° C to 50 ° C with a nominal operating voltage, or if battery operated with a new battery.

2. At an air temperature of 20 ° 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 below the lowest limit in the criteria cited above. 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, 2005
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

During spurious radiated emission measurements a shielded cable was employed for the Hall Effect sensor to reduce an emission at 122.9 MHz to below the limit.

Appendix A Test Setup Figures

FIGURE 1: Conducted Emissions Mains Terminal Measurements

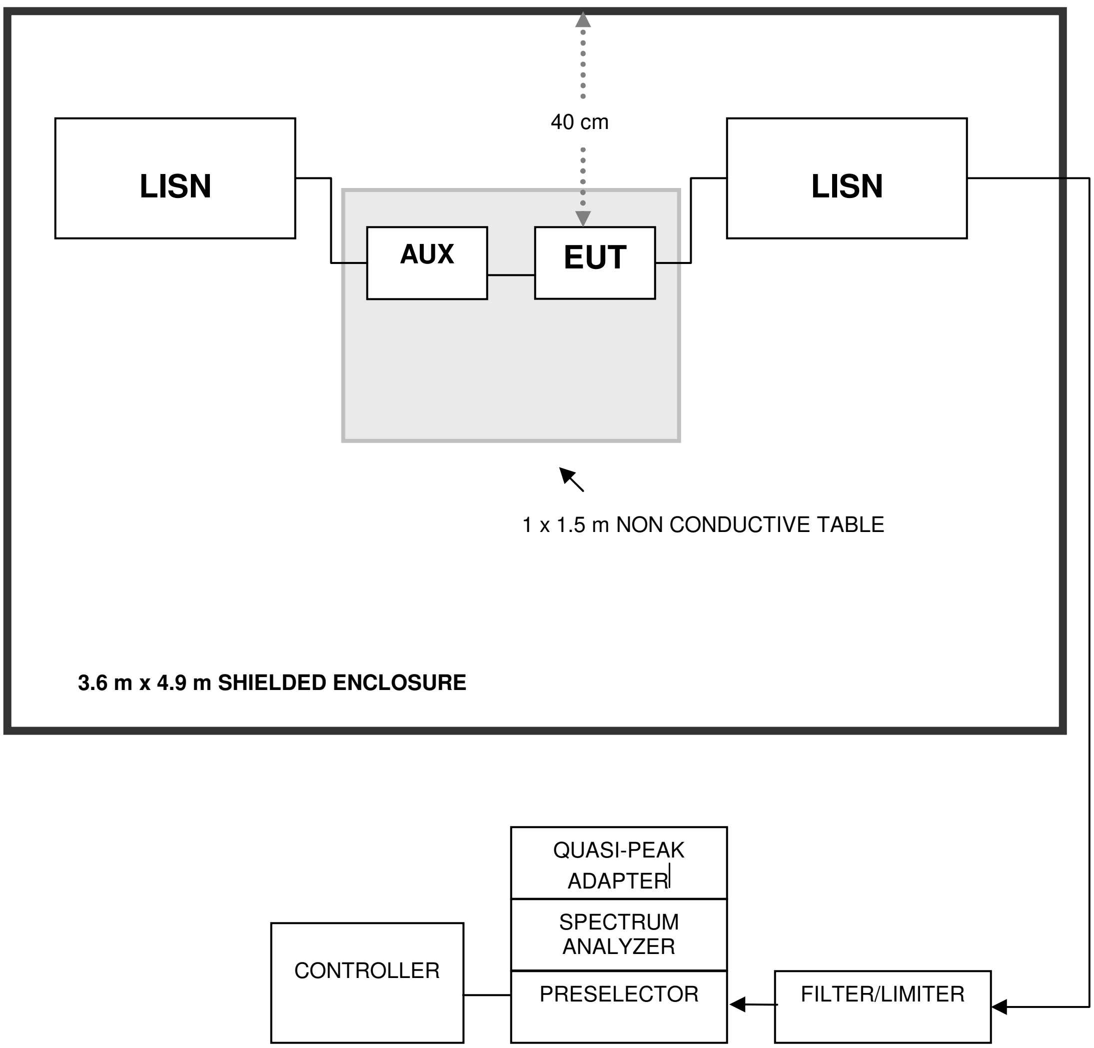
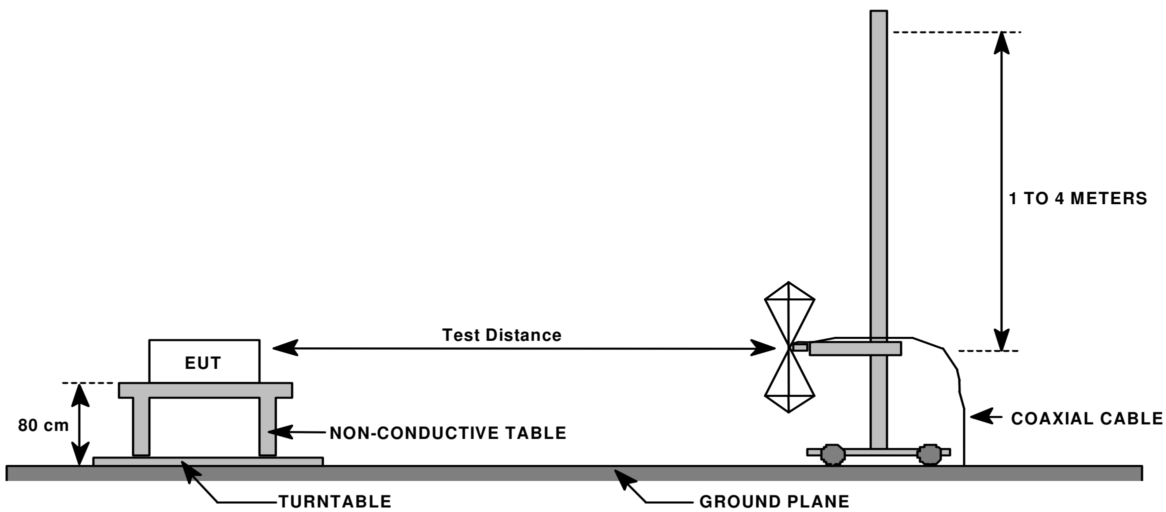


FIGURE 2: Radiated Emissions Test Setup



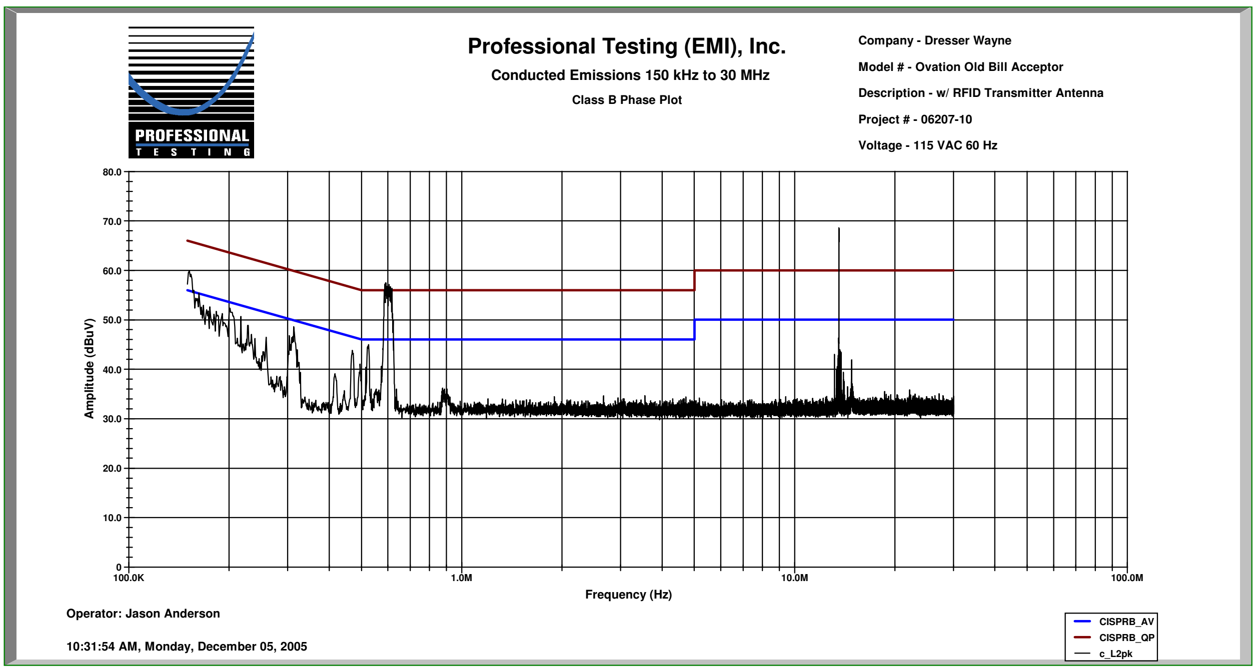
Appendix B Test Results

Conducted Emissions Data Sheet

PROJECT #	DATE	CLASS	LINE	POWER SOURCE
06207-10	Dec 5, 2005	FCC B	PHASE	AC 120/60

COMMENT	RFID On: With antenna, see later section for same test with load resistor substitution. This test is expected to fail at ~13.6 MHz due to the coupling from the antenna.

Frequency Reading (MHz)	Quasi-peak Reading (dBuV)	Average Reading (dBuV)	Quasi-peak Limit (dBuV)	Quasi-peak Margin (dB)	Average Limit (dBuV)	Average Margin (dB)
0.150433	56.2	49.4	66.0	-9.8	56.0	-6.6
0.20353	49.5	48.3	64.5	-14.9	54.5	-6.2
0.22189	49.4	48.3	63.9	-14.6	53.9	-5.6
0.30636	44.9	37.7	61.5	-16.6	51.5	-13.8
0.60153	53.7	45.3	56.0	-2.3	46.0	-0.7
13.5768	68.0	65.1	60.0	8.0	50.0	15.1
13.6463	35.9	17.7	60.0	-24.1	50.0	-32.3
13.6468	36.0	17.7	60.0	-24.0	50.0	-32.3
13.6539	36.0	19.5	60.0	-24.0	50.0	-30.5
13.7201	34.7	19.1	60.0	-25.3	50.0	-30.9



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

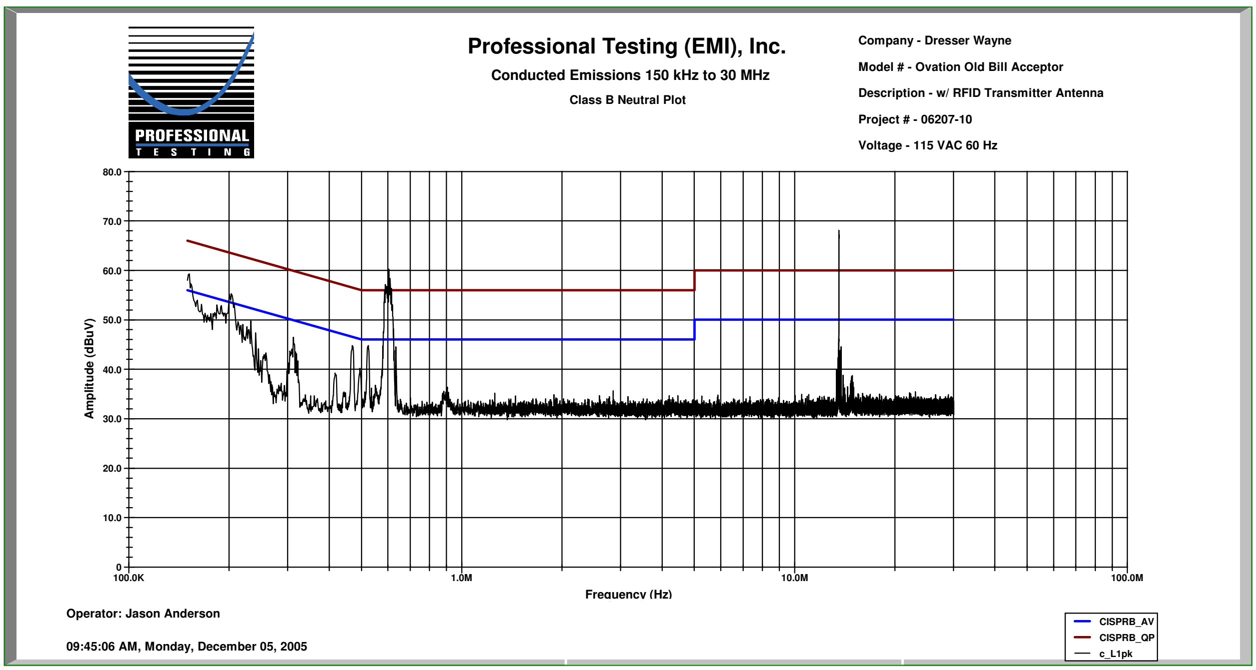
TEST TECHNICIAN: JASON ANDERSON

Conducted Emissions Data Sheet

PROJECT #	DATE	CLASS	LINE	POWER SOURCE
06207-10	Dec 5, 2005	FCC B	NEUTRAL	AC 120/60

COMMENT	RFID On: With antenna, see later section for same test with load resistor substitution. This test is expected to fail at ~13.6 MHz due to the coupling from the antenna.

Frequency Reading (MHz)	Quasi-peak Reading (dBuV)	Average Reading (dBuV)	Quasi-peak Limit (dBuV)	Quasi-peak Margin (dB)	Average Limit (dBuV)	Average Margin (dB)
0.151199	55.1	49.4	66.0	-10.9	56.0	-6.5
0.20345	51.5	49.2	64.5	-12.9	54.5	-5.3
0.20451	51.8	49.2	64.4	-12.6	54.4	-5.2
0.31109	42.1	36.2	61.4	-19.3	51.4	-15.2
0.59126	54.9	44.4	56.0	-1.1	46.0	-1.6
13.5773	67.7	64.8	60.0	7.7	50.0	14.8
13.6446	35.6	19.9	60.0	-24.4	50.0	-30.1
13.6498	35.7	19.7	60.0	-24.3	50.0	-30.3
13.7205	34.4	19.9	60.0	-25.6	50.0	-30.1
13.7873	35.6	18.6	60.0	-24.4	50.0	-31.4



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

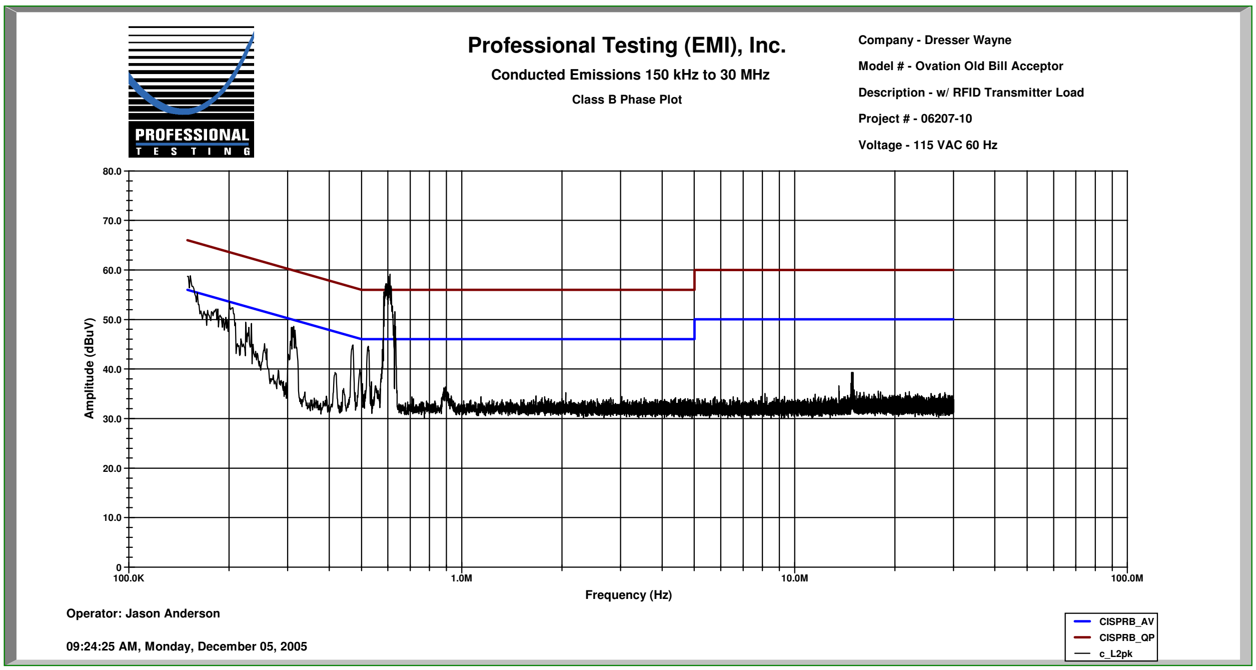
TEST TECHNICIAN: JASON ANDERSON

Conducted Emissions Data Sheet

PROJECT #	DATE	CLASS	LINE	POWER SOURCE
06207-10	Dec 5, 2005	FCC B	PHASE	AC 120/60

COMMENT	RFID On: With load substituted.

Frequency Reading (MHz)	Quasi-peak Reading (dBuV)	Average Reading (dBuV)	Quasi-peak Limit (dBuV)	Quasi-peak Margin (dB)	Average Limit (dBuV)	Average Margin (dB)
0.150691	56.2	49.3	66.0	-9.8	56.0	-6.7
0.19979	49.8	48.6	64.6	-14.8	54.6	-6.0
0.59328	55.2	44.8	56.0	-0.8	46.0	-1.2
0.59527	54.1	45.9	56.0	-1.9	46.0	-0.1
0.60086	54.0	45.3	56.0	-2.0	46.0	-0.7
14.8316	32.9	29.4	60.0	-27.1	50.0	-20.6
14.9896	32.8	28.5	60.0	-27.2	50.0	-21.5



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

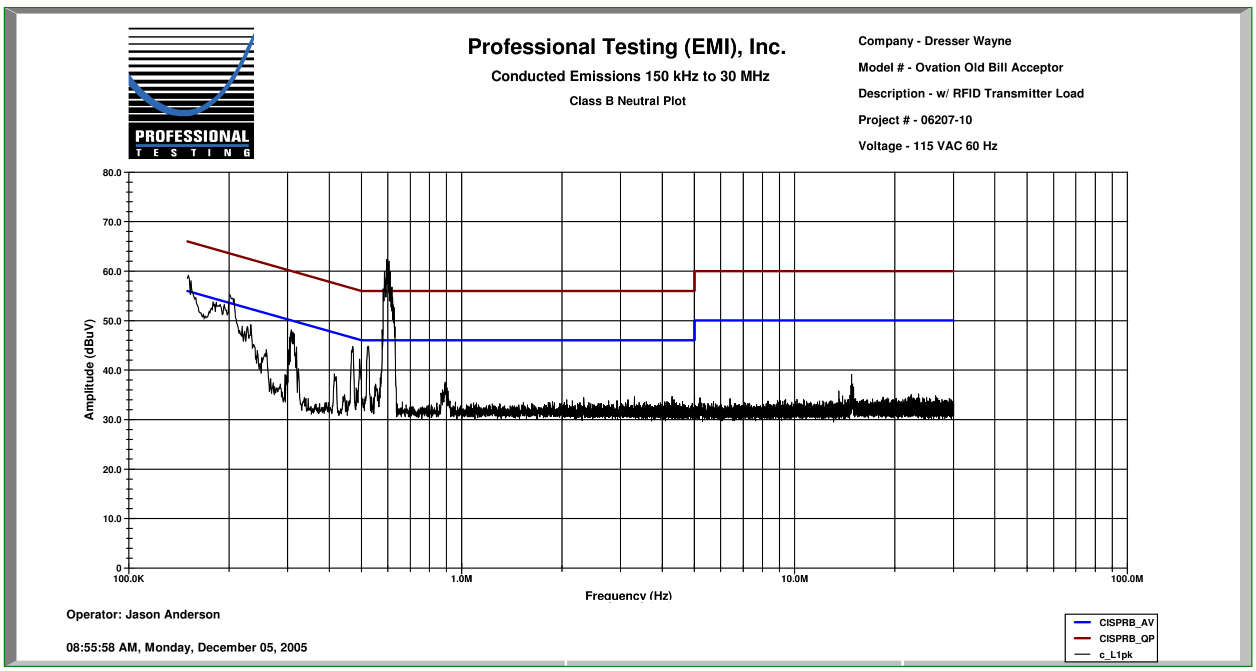
TEST TECHNICIAN: JASON ANDERSON

Conducted Emissions Data Sheet

PROJECT #	DATE	CLASS	LINE	POWER SOURCE
06207-10	Dec 5, 2005	FCC B	NEUTRAL	AC 120/60

COMMENT	RFID On: With load substituted. See page 21 for comparison of ~500 kHz to ~600 kHz emissions to verify failing emission noted below is a pre-existing signal from the Class A emission without the EUT installed.

Frequency Reading (MHz)	Quasi-peak Reading (dBuV)	Average Reading (dBuV)	Quasi-peak Limit (dBuV)	Quasi-peak Margin (dB)	Average Limit (dBuV)	Average Margin (dB)
0.150016	55.4	49.7	66.0	-10.6	56.0	-6.3
0.30704	42.5	36.5	61.5	-19.0	51.5	-15.0
0.4674	42.4	40.9	56.9	-14.6	46.9	-6.0
0.58583	55.9	45.9	56.0	-0.1	46.0	-0.1
0.59428	54.6	46.5	56.0	-1.4	46.0	0.5
14.8388	33.3	29.9	60.0	-26.7	50.0	-20.1



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

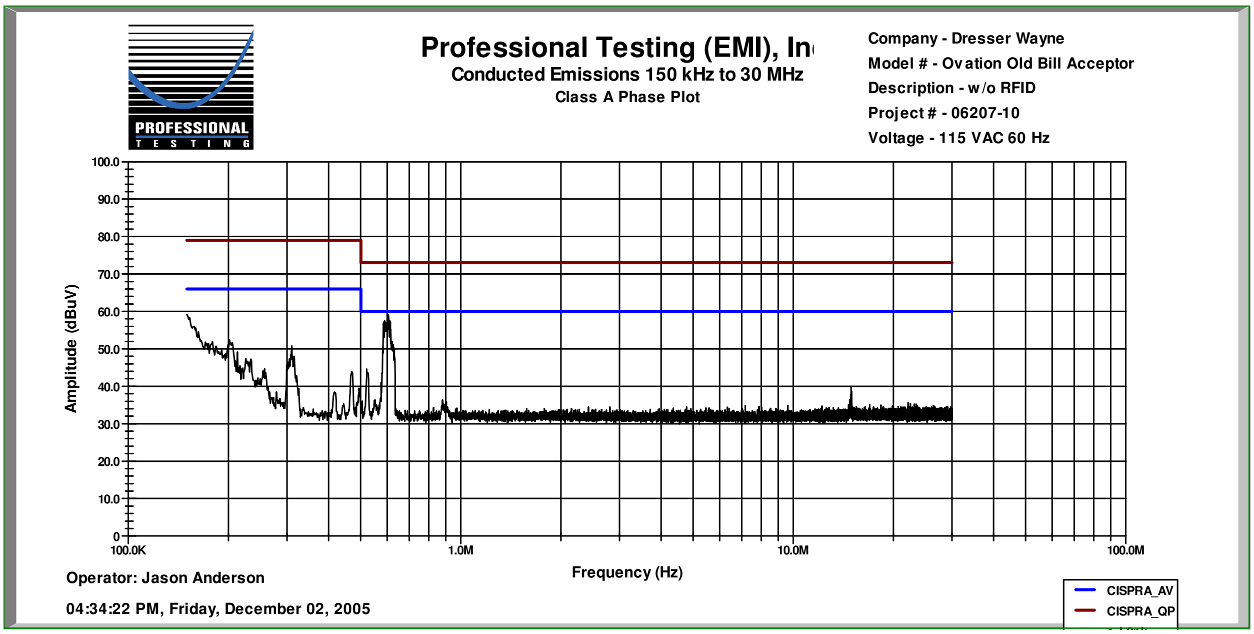
TEST TECHNICIAN: JASON ANDERSON

Conducted Emissions Data Sheet

PROJECT #	DATE	CLASS	LINE	POWER SOURCE
06235-10*	Dec 5, 2005	FCC A	PHASE	AC 120/60

COMMENT	No RFID Installed (Emissions prior to adding the EUT.) *Data annotated for 06207-10.

Frequency Reading (MHz)	Quasi-peak Reading (dBuV)	Average Reading (dBuV)	Quasi-peak Limit (dBuV)	Quasi-peak Margin (dB)	Average Limit (dBuV)	Average Margin (dB)
0.150142	55.5	48.5	79.0	-23.5	66.0	-17.5
0.3054	44.8	37.4	79.0	-34.2	66.0	-28.6
0.46698	42.4	40.8	79.0	-36.6	66.0	-25.2
0.51921	42.0	41.3	73.0	-31.0	60.0	-18.7
0.59623	54.8	44.8	73.0	-18.2	60.0	-15.2
14.9283	35.6	28.1	73.0	-37.4	60.0	-31.9



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

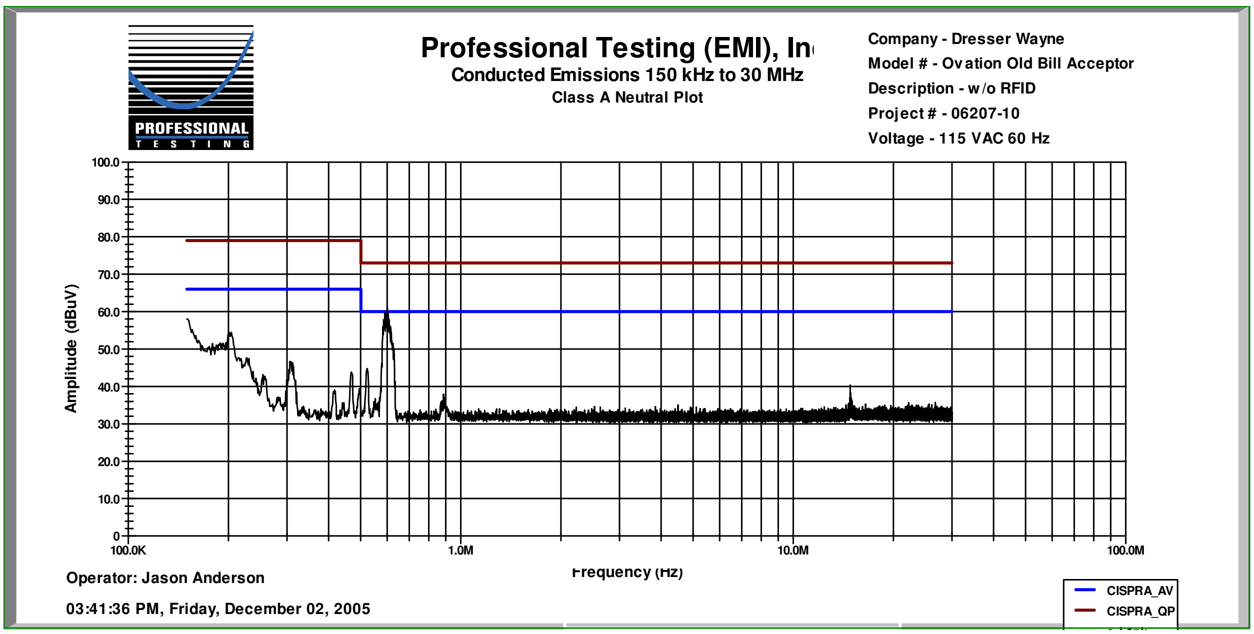
TEST TECHNICIAN: JASON ANDERSON

Conducted Emissions Data Sheet

PROJECT #	DATE	CLASS	LINE	POWER SOURCE
06235-10*	Dec 5, 2005	FCC A	NEUTRAL	AC 120/60

COMMENT	No RFID Installed (Emissions prior to adding the EUT.) *Data annotated for 06207-10.

Frequency Reading (MHz)	Quasi-peak Reading (dBuV)	Average Reading (dBuV)	Quasi-peak Limit (dBuV)	Quasi-peak Margin (dB)	Average Limit (dBuV)	Average Margin (dB)
0.15132	54.2	48.9	79.0	-24.8	66.0	-17.1
0.20167	51.1	49.0	79.0	-27.9	66.0	-17.0
0.30552	41.4	35.8	79.0	-37.6	66.0	-30.2
0.5196	42.1	41.5	73.0	-30.9	60.0	-18.5
0.59853	55.0	44.2	73.0	-18.0	60.0	-15.8
14.8298	33.5	30.3	73.0	-39.5	60.0	-29.7
14.8313	33.5	30.1	73.0	-39.5	60.0	-29.9



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

TEST TECHNICIAN: JASON ANDERSON

Fundamental Radiated Emissions Data Sheet
13.56 MHz Carrier

PROJECT #	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
06255-10	Dec 1, 2005	FCC B	3 m	Loop	CISPR 9 kHz	1 MHz	Peak

COMMENT	

ANTENNA ORIENTATION: **Face On**

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dB uV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Distance Factor (dB)	Corrected Level (dB uV/m)	Limit (dB uV/m)	Margin (dB)
13.56	0	1	68.7	0.0	7.6	1.2	-40.0	37.5	84	-46.5

ANTENNA ORIENTATION: **Edge On**

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dB uV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Distance Factor (dB)	Corrected Level (dB uV/m)	Limit (dB uV/m)	Margin (dB)
13.56	0	1	65.4	0.0	7.6	1.2	-40.0	34.2	84	-49.8

TEST TECHNICIAN: JASON ANDERSON

Spurious Radiated Emissions Data Sheet
Emissions Above 30 MHz

PROJECT #	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
06207-10	Nov 22, 2005	CISPR A	10 m	Bicon	Log	CISPR 120 kHz	1 MHz	QP

COMMENT	

ANTENNA POLARIZATION: Horizontal

Freq. (MHz)	EUT Dir (Deg.)	Antenna Elev. (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
57.1	45	4	45.7	26.6	9.3	2.0	30.4	39.1	-8.7
66.4	0	4	48	26.7	7.7	2.2	31.2	39.1	-7.9
68.2	0	4	51.8	26.7	7.5	2.3	34.9	39.1	-4.2
70	0	4	53.9	26.7	7.4	2.3	36.9	39.1	-2.2
75.6	0	4	46.8	26.7	7.0	2.4	29.5	39.1	-9.6
116.7	0	3	45.3	26.7	12.1	2.9	33.6	43.5	-9.9
122.9	180	3	53.7	26.7	11.8	3.1	41.9	43.5	-1.6
135	360	3.5	53.3	26.7	11.7	3.3	41.6	43.5	-1.9
141.3	0	3.5	48.9	26.7	11.6	3.3	37.2	43.5	-6.3
147.5	360	3	51.8	26.8	12.0	3.4	40.4	43.5	-3.1
239.6	180	3	48.8	27.0	11.4	4.3	37.6	46.5	-8.9
245.8	90	2.5	50.4	27.0	11.7	4.4	39.4	46.5	-7.1
258	270	2.5	48.6	27.0	12.3	4.5	38.4	46.5	-8.1
301	90	2	44	27.1	15.1	5.0	37.0	46.5	-9.5
387.1	0	1.5	42.9	27.3	15.3	5.9	36.8	46.5	-9.7

ANTENNA POLARIZATION: Vertical

Freq. (MHz)	EUT Dir (Deg.)	Antenna Elev. (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
66.4	180	1	46.6	26.7	7.7	2.2	29.8	39.5	-9.7
68.2	90	1	48.1	26.7	7.5	2.3	31.2	39.5	-8.3
70	180	1	49	26.7	7.4	2.3	32.0	39.5	-7.5
77.4	0	1	51.1	26.7	7.4	2.4	34.1	39.5	-5.4
79.9	360	1	52.8	26.7	7.8	2.3	36.2	39.5	-3.3
122.9	270	1	46.6	26.7	11.8	3.1	34.8	43.5	-8.7
135	360	1	50.2	26.7	11.7	3.3	38.5	43.5	-5.0
141.3	270	1	48.2	26.7	11.6	3.3	36.5	43.5	-7.0
147.5	270	1	46.6	26.8	12.0	3.4	35.2	43.5	-8.3
245.8	90	1	46	27.0	11.7	4.4	35.0	46.5	-11.5

TEST TECHNICIAN: JASON ANDERSON

Radiated Emissions Data Sheet
Harmonics Below 30 MHz (2nd Only) and Spurious Emissions

PROJECT #	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
06255-10	Dec 1, 2005	FCC B	3 m	Loop	CISPR 9 kHz	1 MHz	Peak

COMMENT	

ANTENNA ORIENTATION: **Face On**

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dB uV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Distance Factor (dB)	Corrected Level (dB uV/m)	Limit (dB uV/m)	Margin (dB)
27.12	0	1	6.9	0.0	7.9	1.5	-40.0	-23.7	29.5	-53.2

ANTENNA ORIENTATION: **Edge On**

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dB uV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Distance Factor (dB)	Corrected Level (dB uV/m)	Limit (dB uV/m)	Margin (dB)
27.12	0	1	3.9	0.0	7.9	1.5	-40.0	-26.7	29.5	-56.2

TEST TECHNICIAN: JASON ANDERSON

Radiated Emissions Data Sheet
Harmonics Above 30 MHz (3^{rd} to 10^{th})

PROJECT #	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
06255-10	Dec 1, 2005	CISPR A	10 m	Bicon	CISPR 120 kHz	1 MHz	Peak

COMMENT	

ANTENNA POLARIZATION: Horizontal

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dB µV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dB µV/m)	Limit (dB µV/m)	Margin (dB)
40.68	noise	floor	34.5	26.5	10.9	1.8	20.7	40	-19.3
54.24	noise	floor	34.9	26.6	9.9	2.0	20.1	40	-19.9
67.8	noise	floor	37.4	26.7	7.6	2.3	20.5	40	-19.5
81.36	noise	floor	38.4	26.7	8.1	2.4	22.2	40	-17.8
94.92	noise	floor	37.9	26.6	11.6	2.7	25.6	43.5	-17.9
108.48	noise	floor	39	26.7	12.5	2.9	27.7	43.5	-15.8
122.04	noise	floor	37.3	26.7	11.8	3.0	25.5	43.5	-18.0
135.6	noise	floor	36.2	26.7	11.7	3.3	24.5	43.5	-19.0

ANTENNA POLARIZATION: Vertical

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dB µV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dB µV/m)	Limit (dB µV/m)	Margin (dB)
40.68	noise	floor	34.5	26.5	10.9	1.8	20.7	40	-19.3
54.24	noise	floor	34.9	26.6	9.9	2.0	20.1	40	-19.9
67.8	noise	floor	37.4	26.7	7.6	2.3	20.5	40	-19.5
81.36	noise	floor	38.4	26.7	8.1	2.4	22.2	40	-17.8
94.92	noise	floor	37.9	26.6	11.6	2.7	25.6	43.5	-17.9
108.48	noise	floor	39	26.7	12.5	2.9	27.7	43.5	-15.8
122.04	noise	floor	37.3	26.7	11.8	3.0	25.5	43.5	-18.0
135.6	noise	floor	36.2	26.7	11.7	3.3	24.5	43.5	-19.0

TEST TECHNICIAN: JASON ANDERSON

Frequency Tolerance Datasheet

Test Date: Dec 6, 2005
Project: 06207-10

Temperature °C	Frequency MHz	Error Hz
-20	13.559392	-63
-10	13.559445	-10
0	13.559455	0
10	13.559456	1
20	13.559436	-19
30	13.559259	-196
40	13.559119	-336
50	13.559369	-86
-20	13.559392	-63
-10	13.559445	-10

Supply Voltage Freq Stability	
Supply Voltage	**Frequency (MHz)**
115 VAC	13.559436
115%	No change
85%	No change

TEST TECHNICIAN: JASON ANDERSON

Emission Mask Datasheet

Test Date: Dec 1, 2005

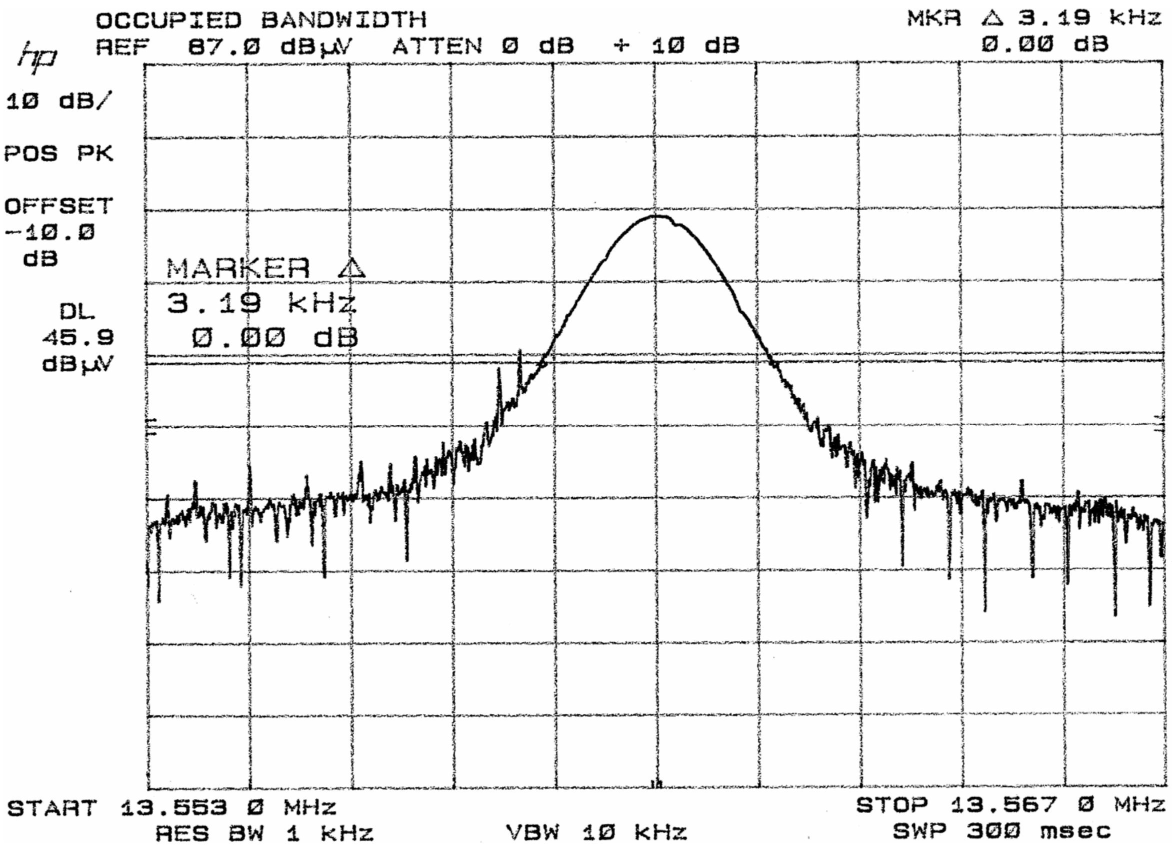
The fundamental, as the highest emission, was 3 dB below the lowest mask level.

No additional measurements required.

TEST TECHNICIAN: JASON ANDERSON

Occupied Bandwidth Datasheet

Test Date: Dec 1, 2005



TEST TECHNICIAN: 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