



MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
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February 25, 2009

Navionics Research, Inc.
595 Vista Hills Court
Eureka, MO 63025

Dear Jim Mimlitz,

Enclosed is the EMC test report for compliance testing of the Navionics Research, Inc., EtherMeter EM-100, tested to the requirements of ICES-003 Issue 4, February 2004 for a Class A Device.

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: (\Navionics Research, Inc.\EMC26372-IC)

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Electromagnetic Compatibility Test Report

for the

**Navionics Research, Inc.
EtherMeter EM-100**

Tested under

**ICES-003 Issue 4, February 2004
for a Class A Device**

MET Report: EMC26372-IC

February 25, 2009

Prepared for:

**Navionics Research, Inc.
595 Vista Hills Court
Eureka, MO 63025**

Prepared by:
MET Laboratories, Inc.
914 W. Patapsco Ave.
Baltimore, MD 21230



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Francis Chau
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 applicable limits. 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 ICES-003, Issue 4 February 2004 for a Class A digital device under normal use and maintenance.

John Mason,
NEBS/Regulatory Manager, Electromagnetic Compatibility Lab



Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	February 25, 2009	Initial Issue.



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List of Terms and Abbreviations

AC	Alternating Current
ACF	Antenna Correction Factor
Cal	Calibration
<i>d</i>	Measurement Distance
dB	Decibels
dBμV	Decibels above one microvolt
dBμV/m	Decibels above one microvolt per meter
DC	Direct Current
E	Electric Field
EUT	Equipment Under Test
<i>f</i>	Frequency
CISPR	Comite International Special des Perturbations Radioelectriques (International Special Committee on Radio Interference)
GRP	Ground Reference Plane
Hz	Hertz
ICES	Interference Causing Equipment Standard
IEC	International Electrotechnical Commission
kHz	kilohertz
LISN	Line Impedance Stabilization Network
MHz	Megahertz
μ H	microhenry
μ F	microfarad
μ s	microseconds
RF	Radio Frequency
RMS	Root-Mean-Square



1.0 Introduction

1.1 Overview

MET Laboratories, Inc. was contracted by Navionics Research, Inc. to perform testing on the EtherMeter EM-100, under Navionics Research, Inc. purchase order number 20090204.

This document describes the test setups, test methods, required test equipment, and the test limit used to perform compliance testing of the EtherMeter EM-100 with the requirements of EN ICES-003 Issue 4, February 2004, Interference-Causing Equipment Standard.

1.2 Test Site

All testing was performed at MET Laboratories, Inc., 914 W. Patapsco Ave., Baltimore, MD 21230. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

1.3 Testing Summary

The following tests specified by ICES-003 were performed with the following results.

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

Specification	Test Description	Compliance	Comments
ICES-003, Issue 4, February 2004	Conducted Emissions – Voltage – Class A	Not Applicable	The EUT has a DC power only.
ICES-003, Issue 4, February 2004	Radiated Emissions – Class A	Compliant	Measured emissions were below applicable limits.

Table 1. Test Summary of ICES Compliance Testing



2.0 Equipment Under Test

2.1 Description of EUT

The EtherMeter EM-100, Equipment Under Test (EUT), is a protocol translator. The EtherMeter reads one or two water meter registers and transmits the readings to a connected computer or logic controller using the MODBUS protocol. The transmission may take place via the EtherMeter's serial or Ethernet port (or both).

2.2 EUT Configuration

The EUT was set up as outlined in Figure 1, Block Diagram of Test Setup. Any removable cards, modules, or components incorporated as part of the EUT are included in the following list

Ref. ID	Name / Description	Model Number	Part Number	Serial Number	Revision
A	ETHERMETER	ETHERMETER	EM-100	000021	2.52

Table 2. Equipment Configuration

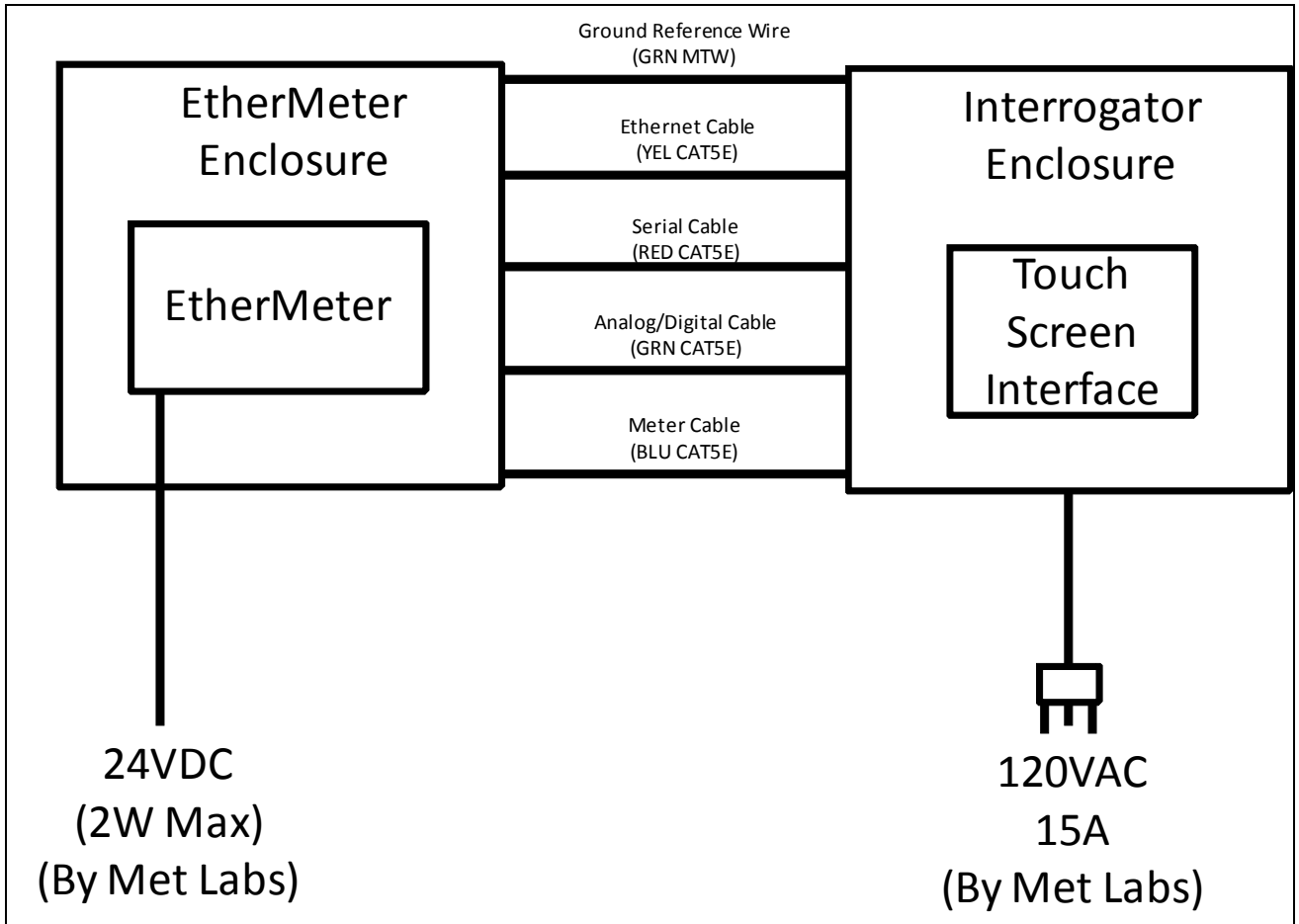


Figure 1. Block Diagram of Test Configuration



2.3 Support Equipment

All support equipment necessary for the operation and testing of the EUT is listed in the following Support Equipment List.

Ref. ID	Name / Description	Manufacturer	Model Number
B	ETHERMETER INTERROGATOR UNIT	NAVIONICS RESEARCH	CUSTOM-BUILT CONTROL PANEL

Table 3. Support Equipment

2.4 Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Point
1	SERIAL PORT	CAT5 (RED)	1	7.6	NO	SERIAL PORT
2	ETHERNET PORT	CAT5 (YELLOW)	1	7.6	NO	ETHERNET PORT
3	PHOENIX TERMINALS 1 AND 2	22 GA MTW	1	N/A	NO	N/A
4	PHOENIX TERMINALS 6,7,8,9,10,11,12,13	22 GA MTW	1	7.6	NO	ANALOG / DIGITAL I/O PORT
5	PHOENIX TERMINALS 14,15,16,17,18,19	22 GA MTW	1	7.6	NO	METER I/O PORT

Table 4. Ports and Cabling Information



2.5 Mode of Operation

The EtherMeter will be connected, via four (4) signal cables plus one (1) ground reference cable, to an external “Interrogator Unit”.

The “Interrogator Unit” contains electronics that will permit the EtherMeter to continuously interrogate two (2) water meter registers.

The “Interrogator Unit” also contains an industrial touch screen computer which will continuously poll the EtherMeter using the MODBUS protocol. The EtherMeter’s serial and Ethernet ports will be utilized simultaneously.

2.6 Method of Monitoring EUT Operation

On the EtherMeter, the green LED (power) should be active during normal operation.

The LCD Display of the EtherMeter should regularly (approximately every 3 seconds) scroll between the two measured meter readings and flow rates during normal operation.

Also, the touch screen of the “Interrogator Unit” will display the two (2) meter readings on its display if the EtherMeter is operational.

If the EtherMeter is not operational, the touch screen display will show 0’s for the two meter readings, and/or the display will show “PLC Comm Error” on the touch screen.

Note: During normal operation in this test, the two (2) displayed flow rates on the touch screen should be ZERO. This is normal.

2.7 Modifications to EUT

No modifications were made to the EUT.

2.8 Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Navionics Research, Inc. upon completion of testing.



3.0 Electromagnetic Compatibility Emission Requirements

3.1 Limits of Mains Terminal Disturbance Voltage

Test Method: CAN/CSA – CEI/IEC CISPR 22:02

Test Requirement(s): ICES-003 Issue 4, February 2004:

The EUT shall meet the Class A limits shown in Table 5:

Frequency Range (MHz)	Class A Limits(dB μ V)	
	Quasi-Peak	Average
0.15 - 0.5	79	66
0.5 - 5	73	60
5 - 30	73	60

Note 1 — The lower limit shall apply at the transition frequencies.

Table 5. Limits for Conducted Disturbances at the Mains Ports of a Class A ITE

Test Results: The EUT was not applicable with the Class A requirement(s) of this section. The EUT has a DC power only.



3.2 Radiated Emission: Limits of Electromagnetic Radiation Disturbance

Test Method: CAN/CSA – CEI/IEC CISPR 22:02

Test Requirement(s): ICES-003 Issue 4, February 2004:

For radiated emission in the frequency range 30 MHz - 1 000 MHz, the EUT shall meet the Class A radiated emission limits shown in Table 6.

Frequency Band (MHz)	Class A Quasi-Peak limits 10 m measurement distance (dB μ V/m)
30 to 230	40
230 to 1000	47
Note 1 – The lower limit shall apply at the transition frequency.	

Table 6. Limits for Radiated Disturbances of a Class A ITE at a Measuring Distance of 10 m

Environmental Conditions for Radiated Emission	
Ambient Temperature:	23.1°C
Relative Humidity:	21%

Test Procedure: The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber. The method of testing, test conditions, and test procedures of CISPR 22 were used. An antenna was located 3 m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1 m and 4 m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. Unless otherwise specified, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

Emissions measured at 3m were normalized using an inverse proportionality factor of 20dB per decade for comparison to the 10 m limit. The physical size of the EUT was taken into account as to avoid near-field effects, which could occur near 30 MHz. See **Error! Reference source not found.** for a picture of the test setup.

Test Results: The EUT was compliant with the Class A requirement(s) of this section.

Test Engineer(s): Zijun Tong

Test Date(s): 02/18/09

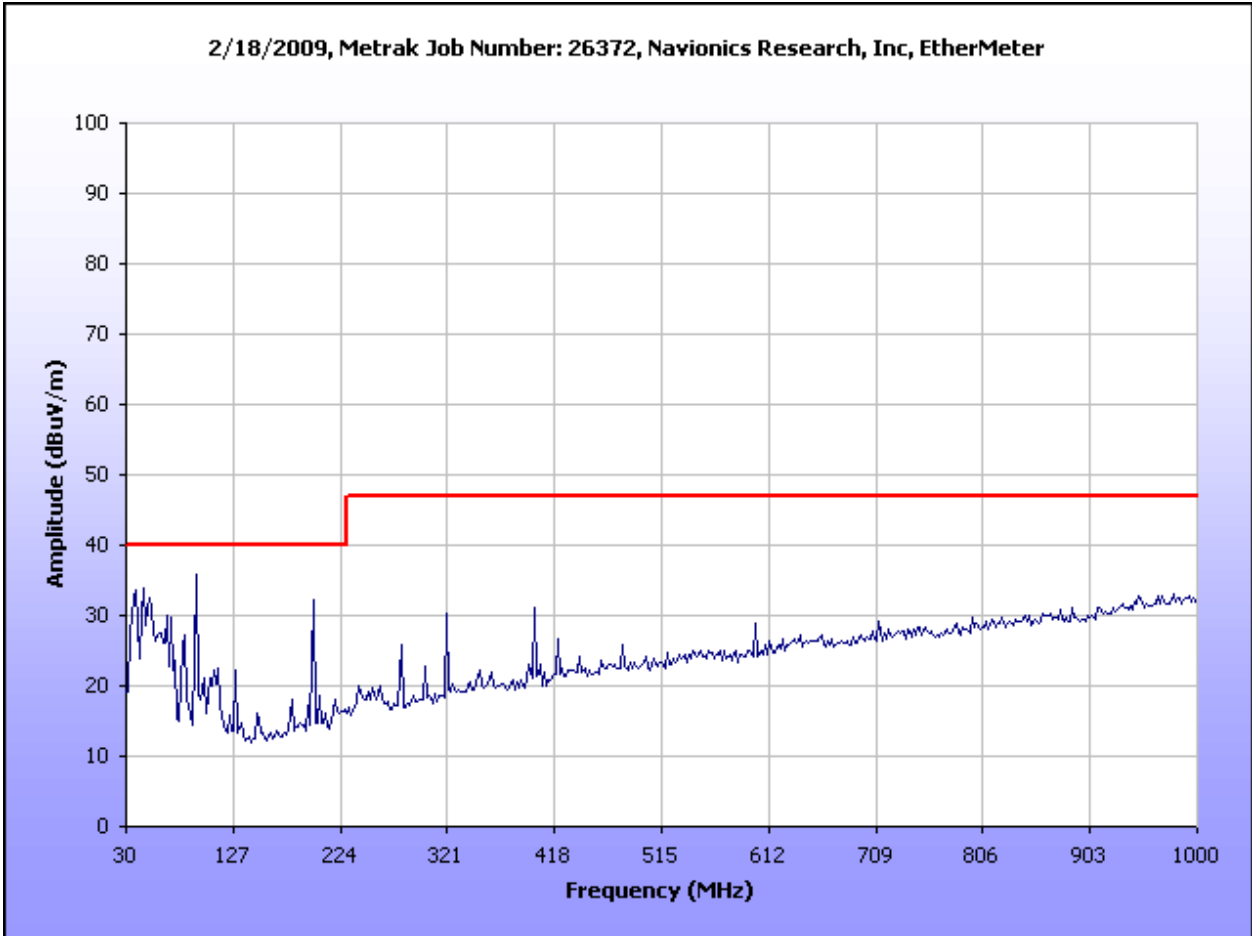


Radiated Emission: Limits of Electromagnetic Radiation Disturbance, Test Results

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna Height (m)	Uncorrected Amplitude (dBuV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
39.762	0	H	1.22	17.50	8.74	0.20	10.46	15.98	40.00	-24.02
39.762	2	V	1.00	34.01	7.63	0.20	10.46	31.38	40.00	-8.62
46.376	0	H	2.14	18.59	9.38	0.21	10.46	17.73	40.00	-22.27
46.376	0	V	1.00	35.29	8.31	0.21	10.46	33.35	40.00	-6.65
52.746	55	H	1.92	16.26	9.76	0.23	10.46	15.79	40.00	-24.21
52.746	0	V	1.00	31.86	8.87	0.23	10.46	30.50	40.00	-9.50
95.087	330	H	3.32	24.26	7.80	0.22	10.46	21.82	40.00	-18.18
95.087	229	V	1.00	39.40	6.81	0.22	10.46	35.96	40.00	-4.04
199.977	360	H	1.90	26.44	10.40	0.39	10.46	26.77	40.00	-13.23
199.977	360	V	1.00	32.46	10.20	0.39	10.46	32.59	40.00	-7.41
319.981	360	H	1.00	23.52	13.60	1.56	10.46	28.22	47.00	-18.78
319.981	292	V	1.49	24.60	14.10	1.56	10.46	29.80	47.00	-17.20

Table 7. Radiated Emission Test Results

Notes: The EUT was tested at 3 m. The data has been corrected for comparison with the 10 m limit using the formula: $20\log(3 \text{ m}/10 \text{ m})$ as expressed in the 'Distance Correction' column.



Plot 1. Radiated Emissions, Pre-Scan

Radiated Emission: Limits of Electromagnetic Radiation Disturbance, Test Setup



Photograph 1. Radiated Emission: Limits of Electromagnetic Radiation Disturbance, Test Setup



4.0 Test Equipment

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

Test Name: Radiated Emissions				Test Date(s): 02/18/09	
MET Asset #	Nomenclature	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4303	ANTENNA; BILOG	SCHAFNER - CHASE EMC	CBL6140A	07/07/2008	07/07/2009
1T4300	SEMI-ANECHOIC CHAMBER # 1	EMC TEST SYSTEMS	NONE	02/17/2006	05/22/2009
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	04/18/2008	04/18/2009
1T4632	THERMO/HYGROMETER	CONTROL COMPANY	S6-627-9	09/25/2007	09/25/2009
1T4457	DC POWER SUPPLY	SORENSEN	DC560-18E	N/A	N/A

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



5.0 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 [¹] digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe [¹] est conforme à la norme NMB-003 du Canada.

¹ Insert either A or B but not both as appropriate for the equipment requirements.