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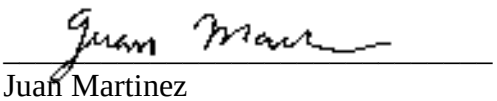
RF Hazard Evaluation Report on the Fleet Management System Model: FMS3500

GRANTEE:	Axiom Navigation, Inc. 800 South Harbor Blvd, Suite 201 Anaheim, CA 92805
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Ave Sunnyvale, CA 94086
REPORT DATE:	June 12, 2001
FINAL TEST DATE:	June 7, 2001

AUTHORIZED SIGNATORY: 

Juan Martinez
EMC Engineer

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GENERAL INFORMATION

Applicant: Axiom Navigation, Inc.
800 South Harbor Blvd, Suite 201
Anaheim, CA 92805

Technical Description

The FMS3500 will be used with either the CMM 8600 or the CMM 8700 Cellular Radio Module, which have been FCC approved. The FMS3500 is a vehicle location and tracking Fleet Management System (FMS). The FMS3500 is typically installed under the dash of a vehicle. Data is retrieved through either the 900 MHz (Section 15.249) transmitter or the CMM cellular modules.

Axom Navigation will be using the following antennas with the FMS3500 unit.

A) Maxrad (M/N: BMMG8350), magnetic mount, ¼ wave, 0 dBi
B) Maxrad (M/N: BMMG8353), magnetic mount, ½ wave, 3 dBi
C) Antenna Specialists (M/N: APD827.1M), window mount antenna, ¼ wave, 2 dBi
D) Allis (M/N: GPS-GS), magnetic mount, ¼ wave, 3 dBi

The antennas will usually be mounted 5-10 feet diagonally from a driver and external to the passenger compartment or cab (i.e, on the roof of a truck or car). In some cases it may be mounted above a seated passenger, but again, on the outside of the vehicle (maybe 8-10 inches from all persons).

Frequency Range

CMM 8600 and 8600 radio modules:
Transmitter: 824.01 – 848.97 MHz
Receiver: 869.01 – 893.97 MHz

Range of Operation Power

3-Watt maximum power output

SCOPE

RF Hazard Evaluation testing was performed for the equipment mentioned in this report. OET Bulletin 65 or the ANSI/IEEE C95.3, "IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave" were used as a test procedure guideline to perform the required test. MPE measurements were performed for this product.

The intentional radiator above was tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

OBJECTIVE

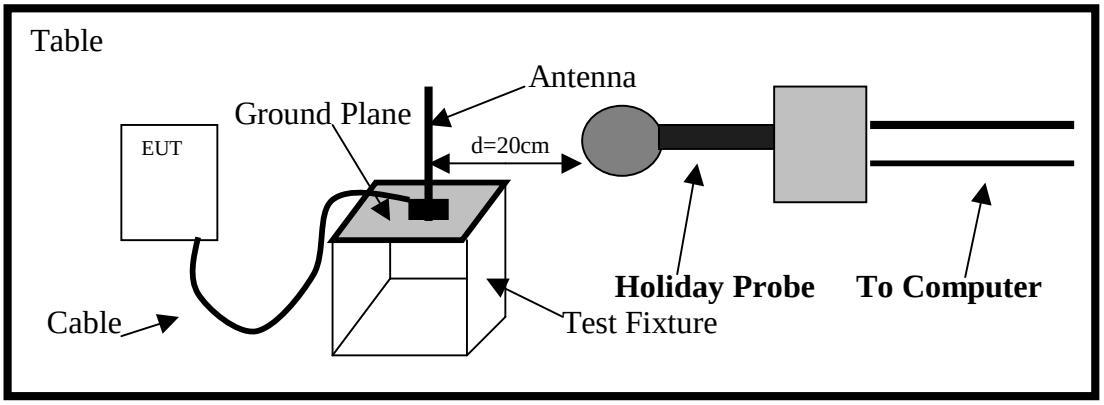
The primary objective of the manufacturer is compliance with Section 2.1091. Certification of these devices is required as a prerequisite to marketing as defined in Section 2.1033.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to FCC. FCC issues a grant of equipment authorization and a certification number upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units subsequently manufactured.

TEST RESULTS

Section 2.1091: Radiofrequency radiation exposure evaluation: Mobile devices.

Test Setup:



MPE Evaluation was performed using the OET Bulletin 65 or the ANSI/IEEE C95.3, "IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave" test procedure, for mobile devices.

A test fixture was built to test the antenna mounted on a ground plane. The ground plane was grounded by braided wire to a known ground source. This configuration will demonstrate the RF exposure levels of the antenna mounted on a ground plane.

The EUT was set to transmit at maximum power, this was verified with a spectrum analyzer. The EUT was set to transmit and the Fundamental frequency set to the middle of the EUT's frequency range. The EUT and its antenna were placed on top of a table, located in a shielded room. The measuring probe was place 20-cm away from the EUT's antenna. The probe was moved around the antenna, while keeping the 20-cm separation. At the same time the probe was raised and lowered in height to measure the maximum points of the antenna(s). The top of the antenna(s) was also measured, 20-cm away. The probe was connected to a computer, which displayed the measured levels in mW/cm^2.

Please, refer to data included under **Exhibit 2**: Test Measurement Data

EQUIPMENT UNDER TEST (EUT) DETAILS

The Axiom Navigation GPS Fleet Management System, which is to be used in industrial environments for data transmission. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number
Axiom Navigation/FMS3500/GPS positioning	N/A
Maxrad/BMMG8350)/¼ wave antenna	N/A
Maxrad/BMMG8353/½ wave antenna	N/A
Antenna Specialists/APD827.1M/Antenna	N/A
Allis/GPS-GS/Antenna	N/A

SUPPORT EQUIPMENT

The following equipment was used as remote support equipment for emissions testing:

Manufacturer/Model/Description	**Serial Number**	**FCC ID Number**

EXTERNAL I/O CABLING

The I/O cabling configuration during emissions testing was as follows:

Cable Description	Length (m)	From Unit/Port	To Unit/Port
N/A			

TEST SOFTWARE

Internal software was used to configure the EUT properly for the required tests.

TEST MODES

During testing the EUT was set to transmit at maximum power.

EXHIBIT 1: Test Equipment Calibration Data

EXHIBIT 2: Test Measurement Data

The following data includes conducted and radiated emission measurements of the FMS3500 unit.

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EMC Test Data

Client:	Axiom Navigation, Inc.	Job Number:	J43763
Model:	FMS3500 with CMM8700 cellular module	T-Log Number:	T43765
		Proj Eng:	David Bare
Contact:	Jeff Burd		
Spec:	2.1091 MPE: mobile devices	Class:	N/A

RF Hazard (Section 2.1091): Mobile Devices

Test Specifics

Objective: This test is required per FCC rule part 2 certification procedure. The objective of this test session is to perform final qualification testing the EUT relative to the specification(s) defined above.

Date of Test: 6/7/01
Test Engineer: Rafael
Test Location: Chamber #1

Config. Used: 1
Config Change: None
EUT Voltage: 12 or 24 Vdc

General Test Configuration

The EUT was located on the turntable for MPE evaluation testing. The transmit antenna was placed in the middle of the table. The Probe was placed 20 cm from the antenna. Tests were performed inside a Chamber.

Ambient Conditions:

Temperature: 25°C
Rel. Humidity: 45%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	MPE Routing Evaluation	.549 mW/cm^2	Pass	Refer to individual runs
2	MPE Routing Evaluation	.549 mW/cm^2	Pass	Refer to individual runs
3	MPE Routing Evaluation	.549 mW/cm^2	Pass	Refer to individual runs
4	MPE Routing Evaluation	.549 mW/cm^2	Pass	Refer to individual runs

Modifications Made During Testing: None

Client:	Axiom Navigation, Inc.	Job Number:	J43763
Model:	FMS3500 with CMM8700 cellular module	T-Log Number:	T43765
		Proj Eng:	David Bare
Contact:	Jeff Burd		
Spec:	2.1091 MPE: mobile devices	Class:	N/A

Section 1.1310 RF Hazard MPE limits
Uncontrolled/polupoated

Frequency (MHz)	**Limit (mW/cm^2)**
300 - 1500 MHz	Freq. **/** 1500

824 MHz / 1500 = .549 mw/cm^2

Run #1: RF Hazard Evaluation Test
Fundamental frequency: 831.99 MHz
Maxrad (M/N: BMMG8350), 0 dBi antenna

Measured	Position	1.1310		Comment
mW/cm^2	Degrees	Limit (mW/cm^2)	Margin	Note
0.250	0	0.549	-0.299	1 and 2
0.115	90	0.549	-0.434	1 and 2
0.291	180	0.549	-0.258	1 and 2
0.212	270	0.549	-0.337	1 and 2

Note 1:	Measured at 20 cm distance as required by OET 65 C, procedure for RF Hazard evaluation for mobile devices
Note 2:	Transmitter set to Maximum Power

Run #2: RF Hazard Evaluation Test
Fundamental frequency: 831.99 MHz
Maxrad (M/N: BMMG8353), 3 dBi antenna

Measured	Position	1.1310		Comment
mW/cm^2	Degrees	Limit (mW/cm^2)	Margin	Note
0.214	0	0.549	-0.335	1 and 2
0.103	90	0.549	-0.446	1 and 2
0.145	180	0.549	-0.404	1 and 2
0.138	270	0.549	-0.411	1 and 2

Note 1:	Measured at 20 cm distance as required by OET 65 C, procedure for RF Hazard evaluation for mobile devices
Note 2:	Transmitter set to Maximum Power

Client:	Axiom Navigation, Inc.	Job Number:	J43763
Model:	FMS3500 with CMM8700 cellular module	T-Log Number:	T43765
		Proj Eng:	David Bare
Contact:	Jeff Burd		
Spec:	2.1091 MPE: mobile devices	Class:	N/A

Run #3: RF Hazard Evaluation Test
Fundamental frequency: 831.99 MHz
Antenna Specialist (M/N: APD827.1M), 2 dBi antenna

Measured	Position	1.1310		Comment
mW/cm^2	Degrees	Limit (mW/cm^2)	Margin	Note
0.147	0	0.549	-0.402	1 and 2
0.192	90	0.549	-0.357	1 and 2
0.213	180	0.549	-0.336	1 and 2
0.225	270	0.549	-0.324	1 and 2

Note 1:	Measured at 20 cm distance as required by OET 65 C, procedure for RF Hazard evaluation for mobile devices
Note 2:	Transmitter set to Maximum Power

Run #4: RF Hazard Evaluation Test
Fundamental frequency: 831.99 MHz
Allis (M/N: GPS-GC), 3 dBi antenna

Measured	Position	1.1310		Comment
mW/cm^2	Degrees	Limit (mW/cm^2)	Margin	Note
0.255	0	0.549	-0.294	1 and 2
0.275	90	0.549	-0.274	1 and 2
0.307	180	0.549	-0.242	1 and 2
0.302	270	0.549	-0.247	1 and 2

Note 1:	Measured at 20 cm distance as required by OET 65 C, procedure for RF Hazard evaluation for mobile devices
Note 2:	Transmitter set to Maximum Power

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EMC Test Data

Client:	Axiom Navigation, Inc.	Job Number:	J43762
Model:	FMS3500 with CMM8600 cellular module	T-Log Number:	T43764
		Proj Eng:	David Bare
Contact:	Jeff Burd		
Spec:	2.1091 MPE: mobile devices	Class:	N/A

RF Hazard (Section 2.1091): Mobile Devices

Test Specifics

Objective: This test is required per FCC rule part 2 certification procedure. The objective of this test session is to perform final qualification testing the EUT relative to the specification(s) defined above.

Date of Test: 6/7/01
Test Engineer: Rafael
Test Location: Chamber #1

Config. Used: 1
Config Change: None
EUT Voltage: 12 or 24 Vdc

General Test Configuration

The EUT was located on the turntable for MPE evaluation testing. The transmit antenna was placed in the middle of the table. The Probe was placed 20 cm from the antenna. Tests were performed inside a Chamber.

Ambient Conditions:

Temperature: 25°C
Rel. Humidity: 45%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	MPE Routing Evaluation	.549 mW/cm^2	Pass	Refer to individual runs
2	MPE Routing Evaluation	.549 mW/cm^2	Pass	Refer to individual runs
3	MPE Routing Evaluation	.549 mW/cm^2	Pass	Refer to individual runs
4	MPE Routing Evaluation	.549 mW/cm^2	Pass	Refer to individual runs

Modifications Made During Testing: None

Client:	Axiom Navigation, Inc.	Job Number:	J43762
Model:	FMS3500 with CMM8600 cellular module	T-Log Number:	T43764
		Proj Eng:	David Bare
Contact:	Jeff Burd		
Spec:	2.1091 MPE: mobile devices	Class:	N/A

Section 1.1310 RF Hazard MPE limits

Uncontrolled/polupoated

Frequency (MHz)	**Limit (mW/cm^2)**
300 - 1500 MHz	Freq. **/** 1500

824 MHz / 1500 = .549 mw/cm^2

Run #1: RF Hazard Evaluation Test
Fundamental frequency: 831.99 MHz
Maxrad (M/N: BMMG8350), 0 dBi antenna

Measured	Position	1.1310		Comment
mW/cm^2	Degrees	Limit (mW/cm^2)	Margin	Note
0.136	0	0.549	-0.413	1 and 2
0.102	90	0.549	-0.447	1 and 2
0.315	180	0.549	-0.234	1 and 2
0.132	270	0.549	-0.417	1 and 2

Note 1:	Measured at 20 cm distance as required by OET 65 C, procedure for RF Hazard evaluation for mobile devices
Note 2:	Transmitter set to Maximum Power

Run #2: RF Hazard Evaluation Test
Fundamental frequency: 831.99 MHz
Maxrad (M/N: BMMG8353), 3 dBi antenna

Measured	Position	1.1310		Comment
mW/cm^2	Degrees	Limit (mW/cm^2)	Margin	Note
0.131	0	0.549	-0.418	1 and 2
0.120	90	0.549	-0.429	1 and 2
0.203	180	0.549	-0.346	1 and 2
0.117	270	0.549	-0.432	1 and 2

Note 1:	Measured at 20 cm distance as required by OET 65 C, procedure for RF Hazard evaluation for mobile devices
Note 2:	Transmitter set to Maximum Power

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EMC Test Data

Client:	Axiom Navigation, Inc.	Job Number:	J43762
Model:	FMS3500 with CMM8600 cellular module	T-Log Number:	T43764
		Proj Eng:	David Bare
Contact:	Jeff Burd		
Spec:	2.1091 MPE: mobile devices	Class:	N/A

Run #3: RF Hazard Evaluation Test
Fundamental frequency: 831.99 MHz
Antenna Specialist (M/N: APD827.1M), 2 dBi antenna

Measured	Position	1.1310		Comment
mW/cm^2	Degrees	Limit (mW/cm^2)	Margin	Note
0.125	0	0.549	-0.424	1 and 2
0.115	90	0.549	-0.434	1 and 2
0.225	180	0.549	-0.324	1 and 2
0.174	270	0.549	-0.375	1 and 2

Note 1:	Measured at 20 cm distance as required by OET 65 C, procedure for RF Hazard evaluation for mobile devices
Note 2:	Transmitter set to Maximum Power

Run #4: RF Hazard Evaluation Test
Fundamental frequency: 831.99 MHz
Allis (M/N: GPS-GC), 3 dBi antenna

Measured	Position	1.1310		Comment
mW/cm^2	Degrees	Limit (mW/cm^2)	Margin	Note
0.214	0	0.549	-0.335	1 and 2
0.167	90	0.549	-0.382	1 and 2
0.235	180	0.549	-0.314	1 and 2
0.299	270	0.549	-0.250	1 and 2

Note 1:	Measured at 20 cm distance as required by OET 65 C, procedure for RF Hazard evaluation for mobile devices
Note 2:	Transmitter set to Maximum Power