An EMS Technologies Company

125 Technology Parkway
Norcross, Georgia, US 30092

October 28, 2004

Manufacturer:	**LXE Inc.** **125 Technology Parkway** **Norcross, GA 30092-2913**
LXE Project:	**04-059**
Equipment Under Test:	**MX3X with RFID module**
Testing Performed By:	**LXE Inc.**
Scope of Testing:	**FCC Part 15, Subpart B Class A**
Section of Standard:	**15.107 - Conducted Emissions** **15.109 - Radiated Emissions**
Test Initiated:	**August 30, 2004**
Test Completed:	**October 21, 2004**

Report Prepared By:	**Report Reviewed By:**
Cyril Binnom Jr.	**Alex McKinney**
EMI/EMC Engineer	**Product Safety Engineer**

Table of Contents

1.0 INTRODUCTION

1.1 Equipment Under Test

The Equipment Under Test (EUT) is the LXE Model MX3X. The MX3X is a rugged, portable, hand-held PC-compatible computer with an Intel PXA-255 400 MHz processor capable of wireless data communications. The MX3X can transmit information using a 2.4 GHz radio (with an internally mounted antenna) and it can store information for later transmission through an RS-232 or Infrared port.

The MX3X is horizontally oriented and features either a CCFL backlighting color display or an electro luminescent backlighting for the greyscale display. The touch-screen display supports graphic features and Windows icons that the Window's CE.NET operating system supports. The keys on the keypad are constructed of a phosphorescent material that can easily be seen in dimly lighted areas.

The MX3X is a MS-Windows compatible computer that can be scaled from a limited function batch computer to an integrated RF scanning computer The MX3X was remodeled to add RFID applications.

1.2 System Configuration

The EUT was configured in a typical manner and evaluated to obtain a worst-case configuration, which consisted of an active MX3X Hand-Held Computer. The software used during testing, entitled "DrawsZAlot" was used to monitor the EUT's performance. This program exercised both communication ports as well as the computer hardware to establish a fully operational unit.

1.3 Scope

To demonstrate conformance with the US Code of Federal Regulations (CFR): Title 47, Part 15, Radio Frequency Devices, Subpart B, Unintentional Radiators and detail the results of testing performed on the LXE Model MX3X.

1.4 Purpose

Testing was performed to evaluate the MX3X's radiated and conducted emissions performance in accordance with 47 CFR § 15.109 and 15.107 respectively.

1.5 Relevant Standards and References

The following standards were used to evaluate the EUT:

1 - ANSI C63.4-1992: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz

2 - US Code of Federal Regulations (CFR): Title 47, Part 15, Radio Frequency Devices, Subpart B, Unintentional Radiators (October 1997).

1.6 Applicability of Standards

The EUT was considered to be Class A according to the definition given in (CFR): Title 47, Part 15, Radio Frequency Devices. Subpart B, Unintentional Radiators Sec. 15.109.

2.0 TEST FACILITIES/RESOURCES

2.1 Location

All testing was performed at test facilities located at the following address:

LXE, Inc.
An Electromagnetic Sciences Company
125 Technology Parkway
Norcross, GA US 30092-2993
Tel: (770) 447-4224
Fax: (770) 447-6928

2.1.1 Radiated Emissions

The Open Area Test Site (OATS) is located in the center of the rooftop of the building and is registered with the FCC and Industry Canada. The roof is located at a height of approximately 8 meters above the ground. The 3 meters radiated emissions test site is an open, flat area (open area) test site approximately 6.2m x 9.2m in dimension. All reflecting objects including test personnel lie outside the perimeter of the ellipse. The 3 meters test site ground plane is made of a 1/4" metal screen mesh which extends 2 meters past the mast and EUT. The ground plane has no gaps with linear dimensions that are greater than 1/10 of a wavelength at the highest frequency of measurement (about 3 cm at 1000MHz). Material of the ground plane, comprised of individual 1/4" metal screen mesh rolls, were soldered at the seams with gaps smaller than 1/10 of the wavelength. The ground plane is connected to the earth ground by ground rods. All wiring is done at floor level around the test site periphery. The radiated emissions test setup is shown in figure 2.4.1-1.

FCC Registration number: 90763
Industry Canada File Number: 46405-1995

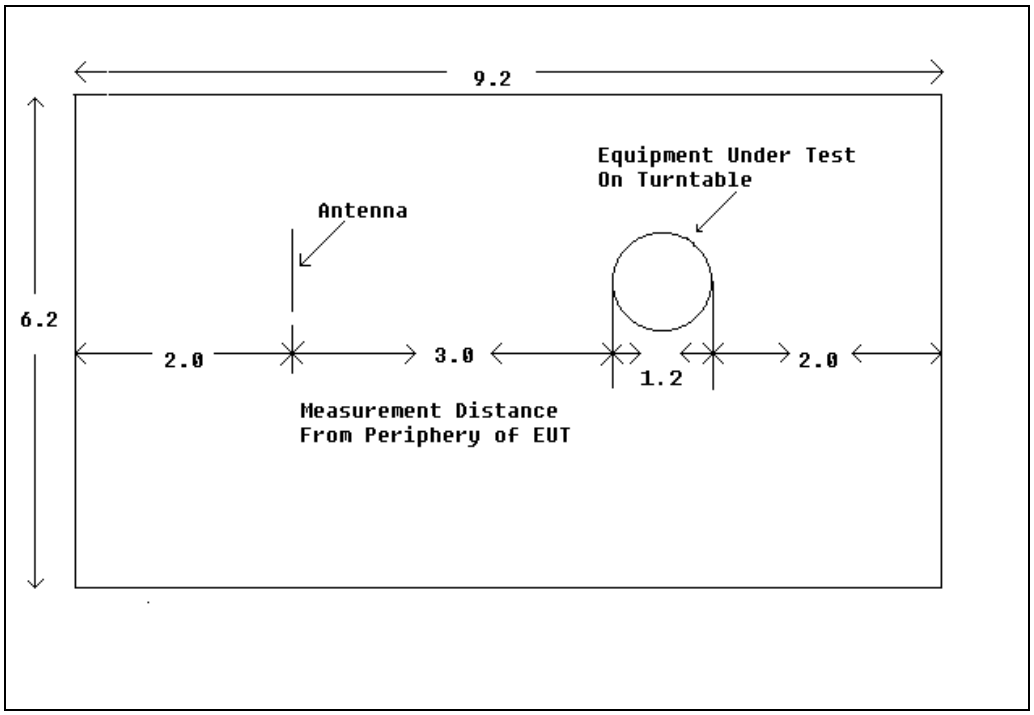


FIGURE 2.4.1-1 OPEN AREA TEST SITE

2.1.2 Conducted Emissions

The conducted emissions test site is a Double Electrically Isolated (DEI) shielded screen room located in the engineering lab. An approximately 3.1 m wide x 2.2 m deep x 2.4 m high shielded screen room was used to perform AC powerline conducted emissions tests. The DEI shielded screen room provides the maximum shielding performance available in a "hear-through, see-through" structure. The DEI shielded screen room is made of 360 degrees double shielded copper screen sheets and is manufactured by Lindgren RF Enclosures, model 14-2/2-0, serial 8147. The use of copper results in unusually good shielding effectiveness in the higher planewave and microwave frequencies. The DEI shielded screen room archives over 120dB of shielding effectiveness from 14KHz to 1GHz. Power for the shielded room is filtered (Lindgren RF Enclosures, P/N 250946, rated 125/250 VAC, 60A, 50/60 Hz). All wiring is done at the wall around the shielded screen room and is electrically bonded to earth ground by a ground rod.

The Line Impedance Stabilization Networks is an EMCO model 3810/2. The LISN housing is electrically bonded to the wall of the shielded screen room. The equipment under test for tabletop testing is placed on a nonconductive table of nominal size, 1m by 1.5m, raised 80cm above the conducting ground plane and 0.8m minimum from the cases of the LISN. The AC powerline emissions test setup is shown in figure 2.4.1-2.

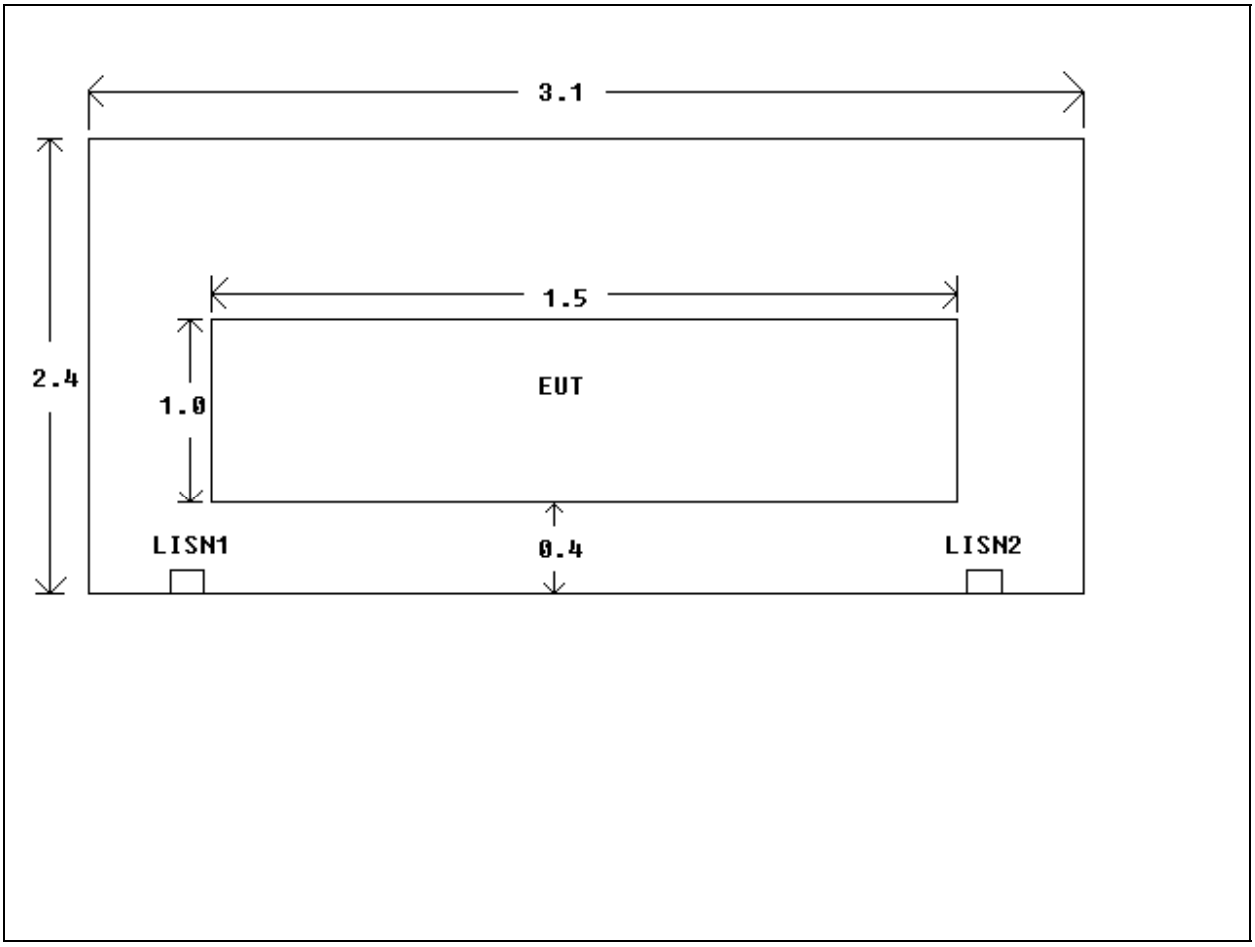


Figure 2.1.2-1 Conducted Emissions Screen Room

2.2 Test Equipment

Table 2.2-1 lists all test and support equipment

TABLE 2.2-1 TEST AND SUPPORT EQUIPMENT

Cal #	Manufacturer:	Equipment Type:	Model #:	Serial #	Recal Date:
53	Hewlett Packard	Spectrum Analyzer	8563E	3304A00657	6/18/05
62	Compliance Design, Inc.	Antenna, Dipole	B1000	265	4/5/05
202	Hewlett Packard	Amp, .01-26.5 GHz	83006A	3104A00543	3/5/05
229	Electro-Metrics	Antenna	RGA-60	6166	5/18/05
230	EMCO	LISN	3810/2NM	9505-1024	4/28/05
515	Tensor	Antenna, Biconical	4104	2157	5/18/05
232	Electro-Metrics	Antenna, Biconical	BIA-25	1165	4/30/05
514	EMCO	Antenna, Log Periodic	3146	9102-3046	4/30/05
234	EMCO	Antenna, Log Periodic	3146	9011-2946	6/1/05
238	Hewlett Packard	Spectrum Analyzer	8591A	3131A02254	5/27/05
239	LXE	Pre-Amp	20-1000GHz	001	5/27/05
451	LXE	RF Cables (High Freq. Double)	7015/6986	MFR-57500	3/15/05
452	EMCO	Mast, Antenna, Mini	2075	PN399235	N/A
453	EMCO	Turntable	2065	PN399230	N/A
99998	Lindgren Enclosure	RF Enclosure	14-2/2-0	8147	N/A

3.0 TEST METHODOLOGY

3.1 Test Description

US Code of Federal Regulations (CFR): Title 47, Part 15, Radio Frequency Devices, Subpart B, Unintentional Radiators (October 1997), was the guiding document for this test.

The EUT was configured and connected to satisfy its functional requirements and represent good installation practices. The EUT laid flat on a non-conductive table measuring 1.5 meters x 1.0 meters x .8 meters. The table was set in the center of a non-conductive remotely controlled turntable approximately 0.91m x 1.2m x 0.8m which was used to measure radiated emissions from all sides of the EUT. The turntable has a center opening that allows cabling to be routed directly down to the conducting ground plane. The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected.

3.2 Justification

The test data reported in section 4.0 was obtained with the EUT configured with an internal scanner and an unterminated RS232 cable occupying the DB9 port. The EUT was tested with a color display as this was considered to emit the worst-case emissions during testing

3.3 Test Procedure

For the radiated emissions tests, measurements were made over the frequency range of 30MHz to 2000MHz. Radiated measurements were made with the Spectrum Analyzer's resolution bandwidth set to 120KHz and video bandwidth set to 300 kHz below 1000MHz and 1MHz and 1MHz for measurements above 1000MHz. The calculation for the radiated emissions strength is as follows:

Corrected Reading = Analyzer Reading - Amplifier Gain + Cable Loss + Antenna Factor - Range Correction

Margin(dB) = Corrected Reading - Applicable Limit

3.4 Test Criteria

Table 3.4-1 below are the radiated and conducted emission limits for Class A Information Technology Equipment (ITE).

TABLE 3.4-1: EMISSION LIMITS

Emission Type	*Frequency Range (MHz)*	*Voltage limits (dB uV)*
Conducted Class A	0.45 to 1.705	60.0
	1.705 to 30.0	69.5
Radiated (10 meters) Class A	30.0 to 88.0	39.0
	88.0 to 216.0	43.5
	216.0 to 960.0	46.0
	Above 960.0	49.5

Detector Function: The HP Spectrum Analyzer with Quasi-Peak detectors and average detector modes are in accordance with ANSI C63.2. All test equipment is calibrated annually or in accordance with the manufacture's specification.

3.5 Support Equipment

The EUT was configured using the support equipment given in table 3.5-1 below.

TABLE 3.5-1 EUT CONFIGURATION

Diagram #	Description	Manufacturer	Model/Part #	Serial #	FCC ID
1(EUT)	MX3X Terminal	LXE	MX3X	N/A	None

3.6 System Block Diagram

Device numbers in block diagram refer to diagram numbers in table 3.4-1 above:

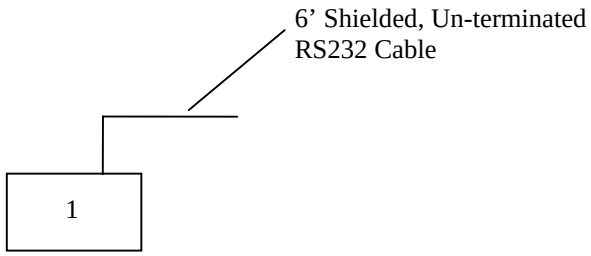


Figure 3.6-1: EUT Set up configuration

3.7 Test Set-up Photographs

3.7.1 Radiated Emissions

Figure 3.7.1-1: Front View

Figure 3.7.1-2: Side View

3.7.2 Conducted Emissions

Conducted not required and photos are not available

4.0 Test Results

4.1 Radiated Emissions

The EUT was found to comply with Class A radiated emissions. Tabulated radiated emissions data is reported in data tables 4.1-1 and 4.1-2 below:

Part 15 Data Form 4.1-1

FCC PART 15 EMISSIONS

DATE: October 21, 2004
EUT: MX3X w/ RFID
MODEL #:
EUT VOLTAGE: 240VAC/50 Hz ____ 120 VAC/60 Hz ____ 12 VDC ____ OTHER: 10.8V battery
TYPE OF TEST:

____	EN55022 CLASS A	√	FCC PART 15 CLASS A
____	EN55022 CLASS B	____	FCC PART 15 CLASS B

PERFORMED PRESCAN √ **Y** ____ **N**

RADIATED EMISSIONS

Frequency (MHz)	Antenna Polarity (H/V)	Antenna Height (cm)	Turntable Position (°)	Uncorrected Reading (dBµV)	Cable Loss + Antenna Factor - Amplifier Gain (dB)	Range Correction (dB)	Corrected Reading (dBµV)	Limit (dBµV)	Margin (dB)	Results
122.022	v	100	74	40.3	-8.42	-10.46	21.42	43.5	22.1	**Pass**
122.022	h	300	0	46.3	-8.64	-10.46	27.20	43.5	16.3	**Pass**
158.363	v	100	0	36.7	-4.75	-10.46	21.49	43.5	22.0	**Pass**
158.363	h	200	109	33.6	-6.09	-10.46	17.05	43.5	26.4	**Pass**
140.263	h	186	83	36.5	-8.47	-10.46	17.58	43.5	25.9	**Pass**
140.263	v	178	100	33.2	-7.57	-10.46	15.18	43.5	28.3	**Pass**
85.9677	v	100	360	53	-12.51	-10.46	30.04	39	9.0	**Pass**
85.966	h	170	265	51.4	-12.94	-10.46	28.00	39	11.0	**Pass**
95.01	h	168	111	50.1	-10.55	-10.46	29.09	43.5	14.4	**Pass**
95.01	v	152	163	49.8	-9.45	-10.46	29.89	43.5	13.6	**Pass**
920	h	195	285	34.1	11.30	-10.46	34.94	46.5	11.6	**Pass**
920	v	161	305	29.5	10.80	-10.46	29.84	46.5	16.7	**Pass**
266.674	h	100	360	43	-5.98	-10.46	26.56	46	19.4	**Pass**
266.674	v	100	135	36.7	-6.28	-10.46	19.96	46	26.0	**Pass**
221.1875	v	100	105	38.3	-8.54	-10.46	19.30	46	26.7	**Pass**
221.1875	h	100	131	39.8	-8.17	-10.46	21.18	46	24.8	**Pass**
298.624	h	100	294	46.7	-4.10	-10.46	32.14	46	13.9	**Pass**

Correction Factor = Cable Loss + Antenna - Amplifier Gain
Sample Calculation: 40.3 - 8.42 - 10.46 = 21.42
Margin: 43.5 – 21.4 = 22.1
Conversion from 3 m to 10 m: -10.46dB

Testing
Performed By: _____
Cyril A. Binnom Jr.

√ Based on the above results, The EUT meets Class A radiated emissions limits given in FCC Part 15

Part 15 Data Form 4.1-2

FCC PART 15 HIGH FREQUENCY EMISSIONS

DATE: October 21, 2004
EUT: MX3X w RFID
MODEL #:
EUT VOLTAGE: 240VAC/50 Hz ____ 120 VAC/60 Hz ____ 12 VDC ____ **OTHER:** 10.8V battery
TYPE OF TEST:

____	EN55022 CLASS A	√	FCC PART 15 CLASS A
____	EN55022 CLASS B	____	FCC PART 15 CLASS B

PERFORMED PRESCAN √ **Y** ____ **N**

HIGH FREQUENCY RADIATED EMISSIONS

Frequency (MHz)	Antenna Distance (m)	Level (dBuV)	Correction Factors (dB)	Corrected Level (dBuV)	Corrected Level (uV/m)	Limit (uV)	Margin (uV)	Final Result (Pass/Fail)
	3							
	3							
	3							

Correction Factor = Cable Loss + Antenna - Amplifier Gain - Range Correction
Conversion from 1 m to 10 m: -20dB

Sample Calculation: 50.3dBuV - 18.29dB = 32.01dBuV
Conversion from dBuV to uV/m: Antilog(32.01/20) = 39.86
Margin: 300 - 39.86 = 260.14

Comments: No signals from the EUT were detected from 1GHz to2GHz.

Testing
Performed By: _____
Cyril A. Binnom

√ Based on the above results, The EUT meets Class A radiated emissions limits given in FCC Part 15

4.2 Conducted Emissions

Tabulated conducted emissions data is reported in table 4.2-1 below:

FCC Part 15 Data Form 4.2-1

FCC PART 15 CONDUCTED EMISSIONS

DATE: October 21, 2004
EUT: MX3X w RFID
MODEL #:
EUT VOLTAGE: 240VAC/50 Hz ____ 120 VAC/60 Hz ____ 12 VDC ____ OTHER: 10.8V battery
TYPE OF TEST:

____	EN55022 CLASS A	√	FCC PART 15 CLASS A
____	EN55022 CLASS B	____	FCC PART 15 CLASS B

CONDUCTED EMISSIONS

Frequency (MHz)	Corrected Reading(dBuV)		Class A Limits (dBuV)	Margin (dB)	
	L1	L2		L1	L2

Comments:

Testing Performed By:
Cyril A. Binnom Jr.

____ Based on the above results, The EUT meets the FCC Part 15 Class A conducted emission limits.

__√__ Due to the absence of an input AC power port, this test was deemed unnecessary. EUT is DC powered.

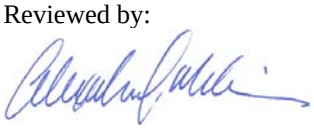
5.0 Conclusion

The product(s) covered by this report has been tested and found to comply with the requirements called out in FCC Part 15 Subpart B Section 15.109 and 15.107.

Prepared by:

Cyril A. Binnom Jr.
EMI/EMC Approvals Engineer
LXE, Inc.
Date: October 28, 2004

Reviewed by:



Alex McKinney
Product Safety Engineer
LXE, Inc.
Date: October 28, 2004