



125 Technology Parkway
Norcross, Georgia, US 30092

Frequency Hopping Spread Spectrum Transmitter

Manufacturer: LXE Inc.

Model: 480824-3300
FCC ID: KDZ4808243300M

LXE Project: 00-086
Class 2 Permissive Change

Scope of Testing: FCC Part 15, Subpart C
Section/Standard: 47 CFR § 15.247

Issue Date: October 25, 2000

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1.0 GENERAL

1.1 Introduction

The purpose of this report is to demonstrate compliance with Part 15, Subpart C of the FCC's Code of Federal Regulations. Testing was performed on-site at LXE Inc., a division of EMS Technologies, Inc.

1.2 Product Description

The equipment under test(EUT) is the combination of the LXE Transceiver model 480824-3300 and the following antennas:

- LXE Part 156426-0001 - 0dBi Patch
- Toko Model DAC2450CT1 - 2.15dBi Omni

These antennas are specifically designed for 2.4 GHz operation and are primarily used with radios installed in LXE Hand Held Computer Terminals (HHT). Each antenna couples to the radio via a custom designed connector satisfying the requirements of section **15.203** of the FCC rules.

The transceiver is a Frequency Hopping Spread Spectrum radio that operates in the band of 2.400-2.4835 GHz at a nominal 100mW. The radio is currently approved by the commission under FCC ID: KDZ480824-3300M, via a private label agreement with Proxim Inc. In May of 1997, LXE filed a Change of Identification application with the FCC to Proxim Inc.'s. FCC ID: IMKRL21PC. A grant of this application was made October 14, 1997.

The combination of the radio, antenna and a suitable host are used in establishing wireless LAN's for applications such as inventory tracking, healthcare and office settings. The radio can only be used in host devices that are equipped with a type 2 PCMCIA interface and the proper software for operation. Selected hosts must be compliant to FCC Part 15, Subpart B rules and regulations among others.

1.3 Approved Antennas

Table 1 below identifies all antennas that are currently approved for use with the 480824-3300 Transceiver. The list includes the new antennas listed in section 1.2.

Table 1: Approved Antennas

LXE P/N	Mfg.	Mfg. P/N	Antenna Type	Connector Type	Gain (dBi)	E.I.R.P (dBm)
153139-0001	Proxim	153139-0001	Omni	R-TNC	0	20
153180-0001	Cushcraft	RTN2400SXR	Omni	R-TNC	0	20
153599-0001	Cushcraft	S2403NF	Omni	N-Female	3	23
153600-0001	Cushcraft	S2403NM	Omni	N-Male	3	23
154712-0001	Mitsubishi	154712-0001	Patch	Custom	0	20
154803-0001	Fujitsu	154803-0001	Patch	Custom	0	20
155104-0001	LXE	155104-0001	Omni	Custom	0	20
990004-0027	Huber&Suner	9090.16.0001	Omni	Custom	1.8	21.8
156426-0001	LXE	156426-0001	Patch	Custom	0	20
None	Toko	DAC2450CT1	Omni	Custom	2.15	22.15

2.0 LOCATION OF TEST FACILITY

The LXE test facility is 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

Radiated emission tests were conducted at the manufacture's test facility at a location specifically prepared for this testing. The radiated emissions test site meets the characteristics of ANSI C63.4:1992, CISPR 16 and EN 55022:1994. This site has been fully described and submitted to the FCC, and accepted in their letter marked 31040/SIT, 1300F2.

3.0 DESCRIPTION OF OPEN AREA TEST SITE

The open area test site(OATS) is located in the center of the rooftop of the building. 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 equipment under test(EUT). 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 at 1000MHz. 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 1.

3.1 Radiated Emissions Testing Facility Drawing

All dimensions are in meters(m)

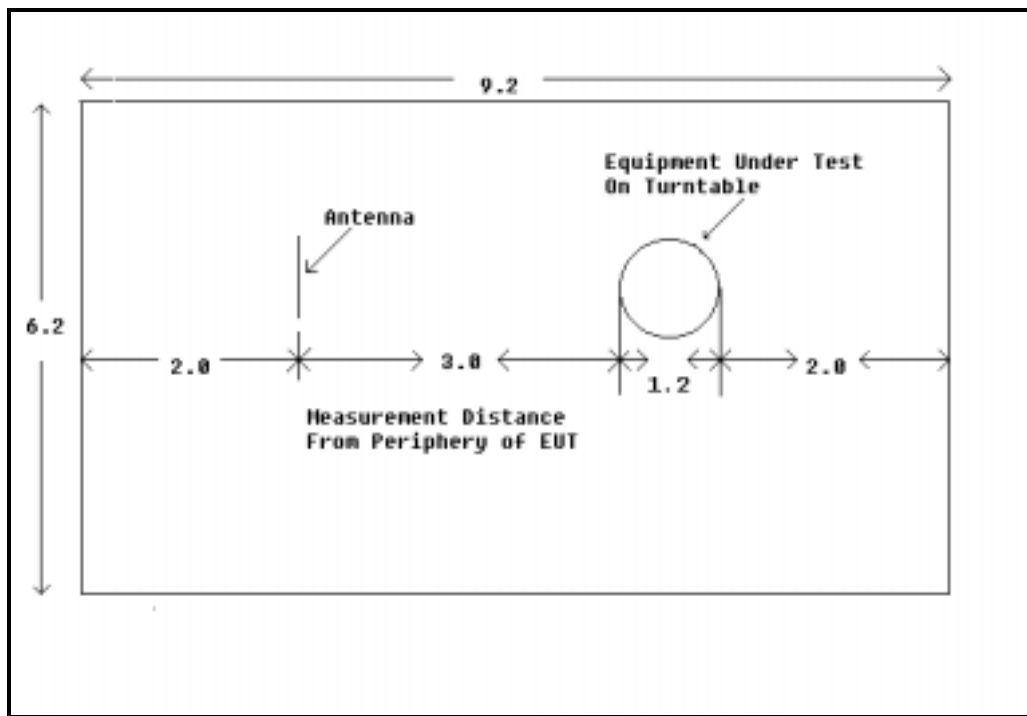


Figure 1: Open Area Test Site(OATS)

4.0 APPLICABLE STANDARD REFERENCES

The following standards were used for this test:

- 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 (CRF): Title 47, Part 15, Radio Frequency Devices, Subpart C, Intentional Radiators (October 1997)

5.0 LIST OF TEST EQUIPMENT

Table 2 contains the test equipment used during all parts of testing.

Table 2: Test and Support Equipment

Cal #	MFG Name	Item Name	Model #:	Serial #	Recal Date:
53	Hewlett Packard	Spectrum Analyzer	8563E	3304A00657	5/4/01
62	Compliance Design, Inc.	Antenna, Dipole	B1000	265	4/12/01
202	Hewlett Packard	Amp, .01-26.5 GHz	83006A	3104A00543	11/9/00
229	Electro-Metrics	Antenna	RGA-60	6166	4/10/01
230	EMCO	LISN	3810/2NM	9505-1024	5/16/01
233	EMCO	Antenna, Biconical	3104C	9012-4360	5/22/01
234	EMCO	Antenna, Log Periodic	3146	9011-2946	6/21/01
238	Hewlett Packard	Spectrum Analyzer	8591A	3131A02254	5/8/01
239	LXE	Pre-Amp	20-1000GHz	001	4/7/01
394	Microwave Circuits	High-Pass Filter	H3G020G2	0001 DC9853	1/27/01
399	Mini Circuits	High-Pass Filter	SHP-1000	none	N/A
450	LXE	RF Cables (High Freq. Short)	none	Copper	11/5/00
451	LXE	RF Cables (High Freq. Double)	7015/6986	MFR-57500	11/5/00
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

6.0 TEST METHODOLOGY

For the radiated emissions tests, measurements were made over the frequency range of 30MHz to 10 times the highest fundamental frequency. Measurements of the radiated field strength were made at a distance of 3m from the boundary of the equipment under test(EUT)and the receiving antenna. The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. A nonconductive remotely controlled turntable approximately 0.91m x 1.2m x 0.8m 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.

Due to high ambient noise levels and small EUT size, radiated emission measurements may be made at a distance of 1 meter. An inverse proportionality factor of 20 dB per decade is used to normalize the measured data to the specified distance to determine compliance. The formula used to calculate an inverse proportionality factor is $20 \log (D1/D2)$, where D1 is the distance used and D2 is the specified distance.

Radiated measurements were made with the Spectrum Analyzer's resolution bandwidth set to 120KHz for measurements above 30MHz and below 1000MHz, and 1MHz for measurements above 1000 MHz.

7.0 SUPPORT EQUIPMENT

Table 3: Support Equipment

Manufacturer	Equipment Type	Model Number	Serial Number	FCC ID
WinBook XP	LapTop Computer	ANL-4	10AUA01756	JRUANL-4M66
DELL	AC/DC Power Adapter	ADP-45GB	N6745067248	NONE

8.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

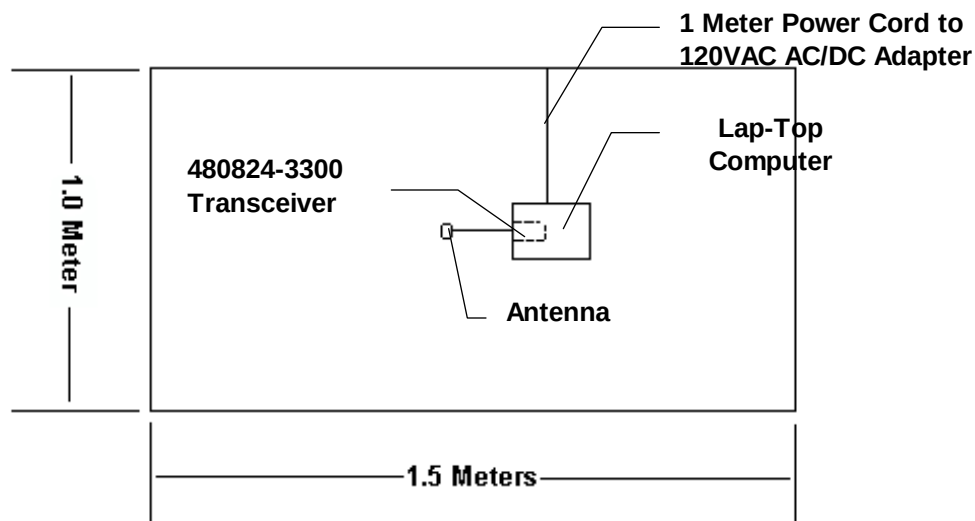


Figure 2: Test Setup Block Diagram

9.0 SUMMARY OF TESTS

Along with the tabular data shown below, plots were also taken of all signals deemed important enough to document. The tables below make reference to plot numbers that can be found following each section.

9.1 Antenna Requirement - FCC Section 15.203

In accordance with section 15.203, both antennas couple to the radio via a unique connector or is soldered in place.

9.2 Radiated Spurious Emissions(Restricted Bands)

Peak radiated spurious emissions found in the restricted bands are reported below in table 4. Plots of significant data points are included separately in this filing.

Table 4: Radiated Spurious Emissions

Frequency (MHz)	Antenna Distance (m)	Level (dBm)	Duty Cycle Correction (dB)	Correction Factors (dB)	Corrected Level (dBm)	Corrected Level (uV/m)	Limit (uV/m)	Margin (dB)	Final Result (Pass/Fail)
LXE Antenna Part 156426-0001									
Channel 1: 2402MHz									
4802	1	-66.67	4.4	7.45	-63.62	147.51	500	352.49	PASS
7203	1	-67.83	4.4	12.09	-60.14	220.34	500	279.66	PASS
9602*	1	-74.71	4.4	15.29	-63.82	144.27	500	355.73	PASS
Channel 2: 2442MHz									
4884	1	-68.17	4.4	7.70	-64.87	127.80	500	372.20	PASS
7326	1	-67.67	4.4	12.49	-59.58	235.04	500	264.96	PASS
9768	1	-67.67	4.4	15.61	-56.46	336.48	500	163.52	PASS
12210*	1	-74.33	4.4	17.07	-61.66	184.89	500	315.11	PASS
Channel 3: 2480MHz									
4959	1	-67.67	4.4	7.93	-64.14	139.04	500	360.96	PASS
7440	1	-68.50	4.4	12.86	-60.04	222.96	500	277.04	PASS
9919	1	-69.50	4.4	15.90	-58.00	281.71	500	218.29	PASS
12400	1	-68.67	4.4	17.08	-55.99	355.06	500	144.94	PASS
14880*	1	-71.67	4.4	17.42	-58.65	261.57	500	238.43	PASS
Toko Antenna Model DAC2450CTI									
Channel 1: 2402MHz									
4804	1	-67.00	4.4	7.45	-63.95	142.11	500	357.89	PASS
7206	1	-68.33	4.4	12.10	-60.63	208.25	500	291.75	PASS
9608*	1	-73.17	4.4	15.31	-62.26	172.49	500	327.51	PASS
Channel 2: 2442MHz									
4884	1	-68.83	4.4	7.70	-65.53	118.45	500	381.55	PASS
7325	1	-67.67	4.4	12.49	-59.58	234.95	500	265.05	PASS
9767*	1	-72.00	4.4	15.61	-60.79	204.35	500	295.65	PASS
Channel 3: 2480MHz									
4960	1	-66.83	4.4	7.94	-63.29	153.21	500	346.79	PASS
7440	1	-69.00	4.4	12.86	-60.54	210.48	500	289.52	PASS
9920*	1	-71.67	4.4	15.90	-60.17	219.48	500	280.52	PASS

* Measurement was of the noise floor and no plots taken.

Notes:

- 1) Correction factors include: Antenna Factor + Cable Attenuation - Amp Gain - Range Correction(if used) - Duty Cycle Correction(if used)
- 2) To achieve better dynamic range, measurements were made at 1 meter instead of 3 meters. Data was corrected by -9.54dB using $20\log(d1/d2)$ formula, where $d1 = 1\text{meter}$ and $d3 = 3\text{ meters}$.
- 3) A correction of -4.4 dB was applied to account for the 60% duty cycle of the device using the formula $20\log(\text{Duty Cycle})$. 60% Duty cycle was determined using the formula $\text{Duty Cycle} = T_{x\text{on}}/(T_{x\text{on}}+T_{x\text{off}})$ (16mS on/11mS off over a 100mS span)

10.0 RF Safety 15.247(b)(4)

Both antennas included in this filing are intended to be used in a hand held device, within 20cm of the user. These devices are defined as a portable device by section 2.1093(b) of the rules, and are exempt from MPE requirements. Additionally, the low power of this device excludes it from the SAR evaluation defined in section 2.1093 and by section 3, supplement C of OET bulletin 65. See section 1.3 for the list of approved antennas.

11.0 Conclusion

The product covered by this report has been tested and found to comply with the requirements as described in Part 15, Subpart C, Section 15.247 of the FCC Code of Federal Regulations.

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Report Reviewed By: _____
Cyril Binnom
EMI/EMC Engineer