

EXHIBIT E – Technical Test Report

FCC ID M4D1010

Measurement/Technical Report

Cardio Theater Holdings

LCS-TX, Rev. F

FCC ID: M4D1010

November 9, 2000

This report concerns (check one):		
Original Grant <input type="checkbox"/>		Class II Change <input checked="" type="checkbox"/>
Equipment Type: <u>Low Power Transmitter</u> below 1 GHz		Rule Part: <u>47 CFR 15.249</u>
Deferred grant requested per 47 CFR 0.457 (d)(1)(ii)?		
Yes <input type="checkbox"/> no <input checked="" type="checkbox"/>		
If yes, defer until:		<u>N/A</u> Date
<u>Cardio Theater Holdings</u> agrees to notify the Commission by:		
<u>N/A</u>		Date
of the intended date of announcement of the product so that the grant can be issued on that date.		
Transition Rules Request per 15.37:		
yes <input type="checkbox"/> no <input checked="" type="checkbox"/>		
If no, assumed Part 15, Subpart C for intentional radiators – new 47 CFR [10-1-92] provision.		
Report prepared by:		
Northwest EMC, Inc. 22975 NW Evergreen Pkwy. Ste 400 Hillsboro, OR 97124 (503) 844-4066 Fax: (503) 844-3826		
Report No. CARD0026		

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1.0 General Information

1.1 Product Description

Manufactured By.....Cardio Theater Holdings.

Address..... 21420-D NW Nicholas Ct. #12-13, Hillsboro, OR 97124

Test Requested By: Rick Hoagland

Model LCS-TX, Rev. F

FCC ID..... M4D1010

Serial Number(s) N/A

Date of Test..... November 8, 2000 through November 9, 2000

Job Number..... CARD0026

The Equipment Under Test (EUT) is the Cardio Theater LCS-TX, Rev. F. The EUT is a four channel stereo FM transmitter operating in 903.6 – 926.2 MHz frequency band. A microcontroller controls all of the functions – reading the keypad, setting the volume (modulation depth), loading the synthesizers and displaying the channel number, volume settings and audio signal levels.

Hardware Description:

- Clocks/Oscillators Frequencies: 38 kHz, 4 MHz, 903.6 - 926.2 MHz
- Ports: (4) Audio/Stereo Inputs, Antenna Input, Power Input
- Antenna: Quarter-Wavelength Monopole, 3 dBi gain, Antenna World, Model BAS87ultra15F

Prepared By:  Vicki Albertson, Technical Report and Documentation Manager	Approved By:  Dean Ghizzone, President
Technical Review By:  Greg Kiemel, Director of Engineering	

1.2 Class II Permissive Changes:

The EUT application for certification was originally granted on March 13, 2000. This is an application for authorization of the following Class II permissive changes:

1. The manufacturer discontinued production of the original power amplifier used in the design (ITT pn ITT2113G). The replacement amplifier is MINI-CIRCUITS amplifier VNA-25. Since this is a 50 ohm in/out device, there are no changes in filters or matching components.
2. Because the overall gain was slightly changed, a different driver-amplifier was used. (ERA-3SM instead of VAM-3).
3. PCB layout was changed slightly due to new part.

1.3 Related Submittals/Grants

The EUT was originally certified on March 13, 2000. This is an application for authorization of Class II permissive change.

1.4 Tested System Details

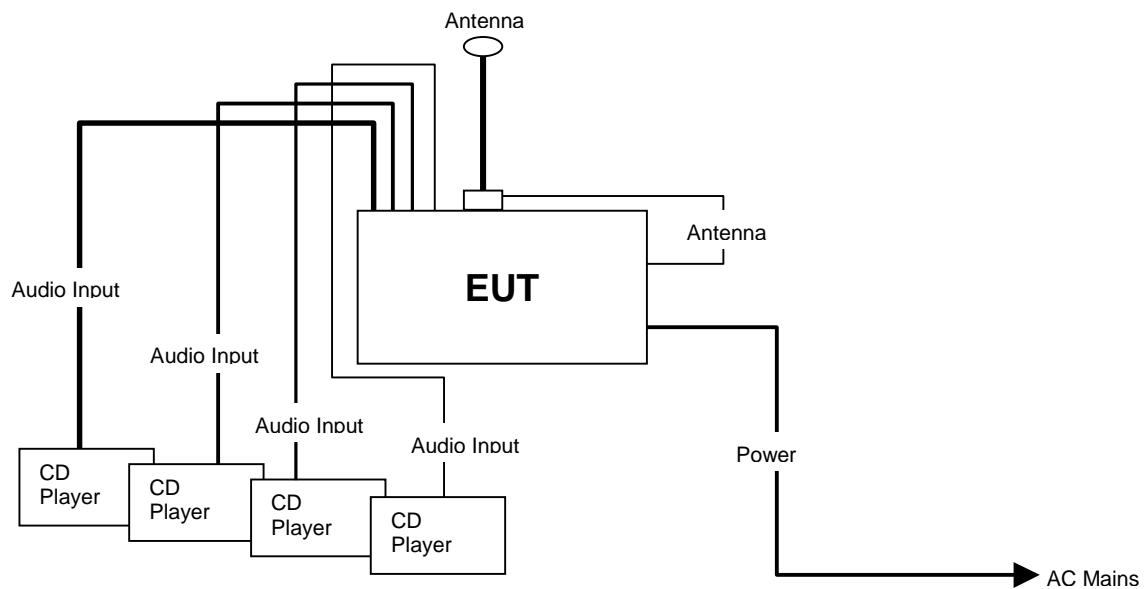
EUT and Peripherals

Item	FCC ID	Description and Serial No.
EUT	M4D1010	LCS-TX, Rev F
CD Player	N/A	Sony Model D-171, Serial No. 8010567
CD Player	N/A	Magnavox Model AZ6820, Serial No. 22947140
Tape Player	N/A	Sony Model WM-EX102, Serial No. 1.88541e+006
Tape Player	N/A	Sony Model WM-EX122, Serial No. 767859

Cables

Cable Type	Shield	Length (meters)	Ferrite	Connector	Connection Point 1	Connection Point 2
Audio Input	Yes	1.0	No	Plastic	EUT	CD Player
Audio Input	Yes	1.0	No	Plastic	EUT	CD Player
Audio Input	Yes	1.0	No	Plastic	EUT	Tape Player
Audio Input	Yes	1.0	No	Plastic	EUT	Tape Player
Power Input	No	2.0	No	AC	EUT	AC Mains
Antenna	Yes	2.0	No	Metal	EUT	Antenna

Figure 1: Configuration of Tested System



1.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4 (1992). Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.6 Test Facility

The semi-anechoic chamber and conducted measurement facility used to collect the radiated and conducted data is located at

Northwest EMC, Inc.
22975 NW Evergreen Pkwy., Ste 400
Hillsboro, OR 97124
(503) 844-4066
Fax: 844-3826

The semi-anechoic chamber, and conducted measurement facility is located in Hillsboro, OR, at the address shown above. This site has been fully described in a report filed with the FCC (Federal Communications Commission), and accepted by the FCC in a letter maintained in our files.

Northwest EMC, Inc. is recognized under the United States Department of Commerce, National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program (NVLAP) for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations. These criteria encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987) as suppliers of calibration or test results. NVLAP Lab Code: 200059-0.

2.0 System Test Configuration

2.1 Justification

The EUT was configured to simulate typical use. Cables were attached to each of the available I/O Ports. Portable CD players or tape players were attached to every Stereo Input. The audio input levels were set to their maximums. The mode of operation utilized for testing was selected in order to best simulate typical EUT use. The measurements were made with the EUT transmitting at Low, Mid and High frequencies in the authorized band.

2.2 EUT Exercise Software

Since there is no external data connection available, no external software can be used.

2.3 Special Accessories

No special accessories are sold with the EUT.

2.4 Equipment Modifications

The following modifications were made in order to achieve EMI compliance:

- Changed Resistor R1230 to 27ohm (output amp match with saw filter).

Please reference exhibit "F", file name "Modifications Letter.pdf" for the manufacturer's attestation statement.

3.0 Antenna Information

The antenna has not changed from the one originally certified with this equipment.

The transmitter uses a special custom made antenna with a calibrated value resistor connected across the antenna terminals. The transmitter has special resistance sensing circuitry incorporated into the output low pass filter. This circuitry enables power to the output amplifier only if the resistance of the connected antenna is within specified limits. This insures that no other antenna will be usable with the LCS transmitter.

4.0 AC Powerline Conducted Emissions

Per 47 15.207(a), if the EUT is connected to the AC powerline directly, then it should be tested to demonstrate compliance with the conducted limits of 15.207.

The AC powerline conducted emissions were measured with the EUT operating in a mode typical of normal operation. The spectrum was scanned from 450 kHz to 30 MHz. The test setup and procedures were in accordance with ANSI C63.4-1992.

Per 47 CFR 15.207, the radio frequency voltage that is conducted back onto the AC power line from the EUT, on any frequency within the 450 kHz to 30 MHz band, does not exceed 250 microvolts.

*The AC Powerline conducted emissions data may be referenced in Exhibit "C",
file name "Conducted Emissions Data.pdf".*

5.0 Radiated Emissions

The field strength of the fundamental and any spurious emissions shall meet the limits as defined in 47 CFR 15.249. The EUT was configured for continuous modulated operation. The spectrum was scanned from 30 MHz to 10 GHz.

While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT's antenna in 3 orthogonal planes (per ANSI C63.4:1992).

5.1 Results

The field strength of the fundamental and any spurious emissions meet the limits as defined in 47 CFR 15.249.

*The final radiated data may be referenced in Exhibit “B”,
file name “Radiated Emissions Data.pdf” and Exhibit “D”, “Field Strength of Fundamental Data.pdf”*

6.0 Field Strength Calculations

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured level. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

where : FS = Field Strength

RA = Measured Level

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

Assume a receiver reading of 52.5 dBuV is obtained. The Antenna Factor of 7.4 and a Cable Factor of 1.1 is added. The Amplifier Gain of 29 dB is subtracted, giving a field strength of 32 dBuV/meter.

$$FS = 52.5 + 7.4 + 1.1 - 29 = 32 \text{ dBuV/meter}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(32 \text{ dBuV/m})/20] = 39.8 \mu\text{V/m}$$

6.1 Measurement Bandwidths

Peak Data

9 kHz – 150 kHz	1 kHz
150 kHz - 30 MHz	10 kHz
30 MHz - 1000 MHz	100 kHz
1000 MHz - 10000 MHz	1000 kHz

Quasi-peak Data

9 kHz – 150 kHz	200 Hz
150 kHz - 30 MHz	9 kHz
30 MHz - 1000 MHz	120 kHz

7.0 Measurement Equipment

Instrument	Manufacturer	Model	Serial No.	Cal Due
Pre-Amplifier	Amplifier Research	LN1000A	25660	12/2/2000
Spectrum Analyzer	Hewlett-Packard	8591A	2943A00519	5/16/2001
LISN	Solar	9252-50-R-24-BNC	971623	7/6/2001
LISN	Solar	9252-50-R-24-BNC	992801	7/6/2001
Spectrum Analyzer	Hewlett-Packard	8566B	2747A05213	1/19/2001
Antenna, Horn	EMCO	3115	9710-5305	7/8/2001
Pre-Amplifier	Miteq	AMF-4D-005180-24-10P	456374	12/2/2000
Quasi-Peak Adapter	Hewlett-Packard	85650A	2811A01353	1/19/2001
Antenna, Biconilog	EMCO	3141	9906-1146	12/2/2000