Measurement/Technical Report

MTH Electric Trains, Inc., Z4000 Remote Commander

FCC ID: OT8Z4KR

July 22, 1999

This report concerns (check one): Original Grant__√__ Class II Change_____

Equipment Type: Intentional Radiator (FCC Part 15.249)

Deferred grant requested per 47 CFR 0.457 (d)(1)(ii)? yes_____ no__X__

If yes, defer until: _____N/A_____ date

Cardio Theater agrees to notify the Commission by: _____N/A_____ 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_____ no__X__

If no, assumed Part 15, Subpart B for unintentional radiators - new 47 CFR [10-1-92] provision.

Report prepared by:

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1.0 General Information

1.1 Product Description

Manufactured By .....MTH Electric Trains, Inc.

Address .....3820 M-139, St. Joseph, MI 49085-9605

Test Requested By: .....Eduard Vaynberg – Seitz & Associates

Model .....Z4000 Remote Commander

FCC ID OT8Z4KR

Serial Number(s) .....N/A

Date of Test.....July 22, 1999

Job Number.....SEIT0042.1

The Equipment Under Test (EUT) is the MTH Electric Trains Z4000 Remote Commander Transmitter.

Hardware Description:

- Clocks/Oscillators Frequencies: 3.58 MHz, 916.5 MHz
- Ports: Modular cable to connect Receiver to Train Power Supply
- Antenna: Microstrip slot antenna, printed on top side of the circuit board assembly

1.2 Related Submittals/Grants

None.

1.3 Tested System Details

EUT and Peripherals

Item	FCC ID	Description and Serial No.
EUT	OT8Z4KR	MTH Electric Trains, Z4000 Remote Commander , Low Power Transmitter Model 40-4001, Serial No. None.
Receiver		MTH Electric Trains, Z4000 Remote Commander Receiver Model 40-4002, Serial No. None.
Power Supply		N/A

Cables:

Item	Description
Power	0.5 meters in length. Not shielded and no ferrite beads. Plastic connector. Connected from the EUT (Receiver) to the Power Supply.

1.4 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. Please reference Appendix I for further detail on Test Methodology.

1.5 Test Facility

The Open Area Test Site and conducted measurement facility used to collect the radiated and conducted data is located at

Northwest EMC, Inc.
120 South Elliott Road
Newberg, OR 97132
(503) 537-0728
Fax: 537-0735

The Open Area Test Site, and conducted measurement facility used to collect this data is located at the address shown above. This site has been fully described in a report filed and accepted by the FCC. (31040/SIT)(1300B3). It is also recognized under the National Voluntary Laboratory Accreditation Program (NVLAP Lab Code: 200059-0) for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations.

Northwest EMC, Inc., has been assessed and accredited by NEMKO (Norwegian testing and certification body) for European emissions and immunity testing. As a result of NEMKO's laboratory assessment, they will accept test results from Northwest EMC, Inc., for product certification (Authorization No. ELA 119).

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. Where applicable, peripherals were attached to the I/O Cables. The mode of operation utilized for testing was selected in order to best simulate typical EUT use.

2.2 EUT Exercise Software

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

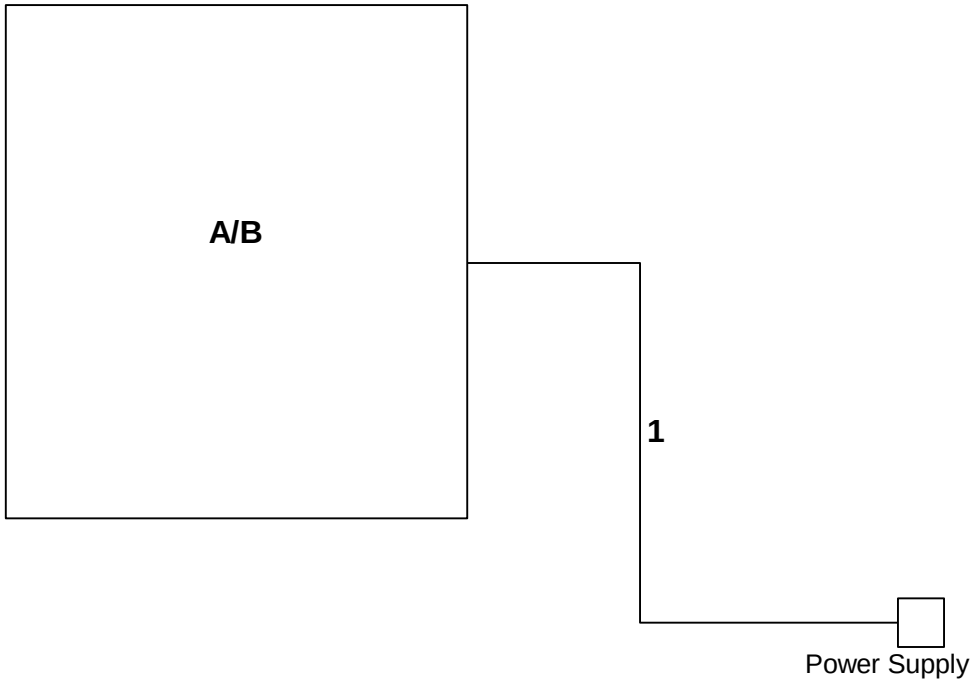
2.3 Special Accessories

No special accessories are sold with the EUT.

2.4 Equipment Modifications

No EMI suppression devices were added or modified. The EUT was tested as delivered.

Figure 2.1: Configuration of Tested System



3.0 Radiated Emissions Data

3.1 The following data lists the six most significant emission frequencies, total (corrected) levels, and specification margins. Correction factors, antenna height, table azimuth, etc., are contained in the data sheets immediately following. Explanation of the correction factors is given in paragraph 3.2 of this report. Complete graphs and data sheets may be referenced in an attachment to this report. Minimum margins are listed below:

FCC Class B Specification Limits

Transmit

Frequency (MHz)	Detection	Total Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)*	Polarization
916.434	AV	71.2	94.0	22.8	Horizontal
916.486	AV	69.6	94.0	24.4	Vertical

Judgment: Passed, minimum margin of 22.8 dB.

Harmonics

Frequency (MHz)	Detection	Total Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)*	Polarization
4582.300	AV	43.1	54.0	10.9	Horizontal
4582.300	AV	41.0	54.0	13.0	Vertical
3665.800	AV	40.5	54.0	13.5	Vertical
4988.500	AV	39.2	54.0	14.8	Vertical
1832.900	AV	37.8	54.0	16.2	Horizontal
3665.800	AV	36.9	54.0	17.1	Horizontal

Judgment: Passed, minimum margin of 10.9 dB.

Test Personnel:

Tester Signature: Jennifer Hewitt Date: 07/22/99

Typed/Printed Name: Jennifer Hewitt

3.2 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 dBuV/meter
Level in uV/m = Common Antilogarithm [(32 dBuV/m)/20] = 39.8 uV/m

3.3 Measurement Bandwidths

Peak Data

150 kHz - 30 MHz.....10 kHz
30 MHz - 1000 MHz.....100 kHz
1000 MHz - 2000 MHz.....1000 kHz

Quasi-peak Data

150 kHz - 30 MHz..... 9 kHz
30 MHz - 1000 MHz.....120 kHz

All radiated measurements are quasi-peak unless otherwise stated. A video filter was not used.
All conducted measurements are peak unless otherwise stated. A video filter was not used.

4.0 Measurement Equipment

Instrument	Manufacturer	Model	Serial No.	Cal Due
Spectrum Analyzer	Hewlett-Packard	8568B	2517A01408	08/16/00
Spectrum Analyzer	Hewlett-Packard	8593EM	3536A00134	04/05/00
Antenna, Bicon	EMCO	3104C	9608-4750	12/29/99
Antenna, Dipole	EMCO	3121C-DB4	9211-866	03/05/00
Antenna, Horn	EMCO	3115	9710-5305	05/08/00
Pre-Amplifier 0.5-18 GHz	Miteq	AMF-4D-005180-24-10P	614304	08/07/00
Antenna, Log Periodic	EMCO	3146	9006-2809	12/30/99
Pre-Amplifier	Amplifier Research	LN1000AM3	21913	11/17/99
Quasi-Peak Adapter	Hewlett-Packard	85650A	3303A01862	08/16/00

Appendix I: Measurement Procedures

Each frequency was measured in both the horizontal and vertical antenna polarizations.

The EUT position was maximized for each frequency, for both the horizontal and vertical antenna polarizations, using a remotely controlled turntable.

The antenna height was varied from 1 – 4 meters at each frequency, for both the horizontal and vertical positions to maximize the emission level.

The cable and peripheral positions were manipulated to ensure maximum levels at each frequency for both horizontal and vertical antenna polarizations.

All measurements with less than 3 dB margin, as measured with a broadband antenna (Biconical/Log Periodic), were then measured with a tuned dipole antenna.

30 MHz – 1000 MHz measurements are made at an antenna to EUT distance of 10 meters.

1000 – 2000 MHz measurements are made at an antenna to EUT distance of 3 meters.