PCTEST Engineering Laboratory, Inc.

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CERTIFICATE OF COMPLIANCE

ZOLTRIX, Inc.
41778 Christy Street
Fremont, CA 94538
Attn: Andrew Ma, General Manager

Dates of Tests: June 16-17, 1998
Test Report S/N: B.980609407.H4T
Test Site: PCTEST Lab, MD U.S.A.
Job No.: CHANEY #8009A

FCC IDENTIFIER **H4TFM-RIB3HC**

APPLICANT **ZOLTRIX, INC.**

Rule Part(s):	**FCC Part 15 Subpart B**
Equipment Class:	**Class B Digital Device / Peripheral (JBP)**
EUT Type:	**16-Bit ISA Bus Data/Fax/Voice Modem Card**
Max. Baud Rate(s):	**56,000 (Flex) bps (Data Modem)**
	14,400 bps (Fax Send/Receive)
Crystal/Oscillator(s):	**28.224 MHz**
Model:	***FM-RIB3HC***

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-1992 with the following remarks (**Note Codes**): (#37):

* (#68) This Grant does not pertain to Part 68 Registration requirements.

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

PCTEST certifies that no party to this application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 853(a).

Randy Ortanez
President & Chief Engineer

NVLAP®
Lab Code 100431-0

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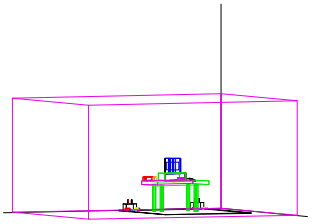
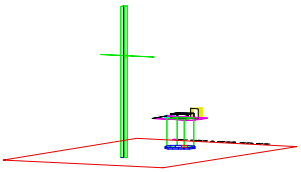
MEASUREMENT REPORT





Scope - Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.

Applicant Name:	**ZOLTRIX, INC.**
Address:	**41778 Christy Street** **Fremont, CA 94538**
Attention:	**Andrew Ma, General Manager**

- **FCC ID:** **H4TFM-RIB3HC**
- **Class:** **B Digital Device / Peripheral (JBP)**
- **EUT Type:** **16-Bit ISA Bus Data/Fax/Voice Modem Card**
- **Trade Name:** ***ZOLTRIX***
- **Model:** ***FM-RIB3HC***
- Max. Baud Rate(s): 56,000 (Flex) bps (Data Modem)
14,400 bps (Fax Send/Receive)
- Crystal/Oscillator(s): 28.224 MHz
- Ports/Connectors: (2) RJ-11C: Line & Phone
(2) Mini-jack: Audio IN & OUT
- FCC Rule Part(s): Part 15 Subpart B
- Test Procedure: ANSI C-63.4 (1992)
- Dates of Tests: June 16-17, 1998
- Place of Tests: PCTEST Lab, Columbia, MD U.S.A.
- Test Report S/N: B.980609407.H4T
- Job No.: CHANEY #8009A

Note: This report does not include FCC Part 68 testing and registration.

NVLAP
Lab Code 100431-0

Introduction

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz (ANSI C63.4-1992) was used in determining radiated and conducted emissions emanating from **ZOLTRIX, Inc. 16-Bit ISA Bus Data/Fax/Voice Modem Card FCC ID: H4TFM-RIB3HC.**

These measurement tests were conducted at ***PCTEST Engineering Laboratory*** facility in New Concept Business Park, Guilford Industrial Park, Columbia, Maryland. The site address is 6660-B Dobbin Road, Columbia, MD 21045. The test site is one of the highest points in the Columbia area with an elevation of 390 feet above mean sea level. The site coordinates are 39°11'15" N latitude and 76°49'38" W longitude. The facility is 1.5 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. There are no FM or TV transmitters within 15 miles of the site. The detailed description of the PCTEST measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4 on October 19, 1992.

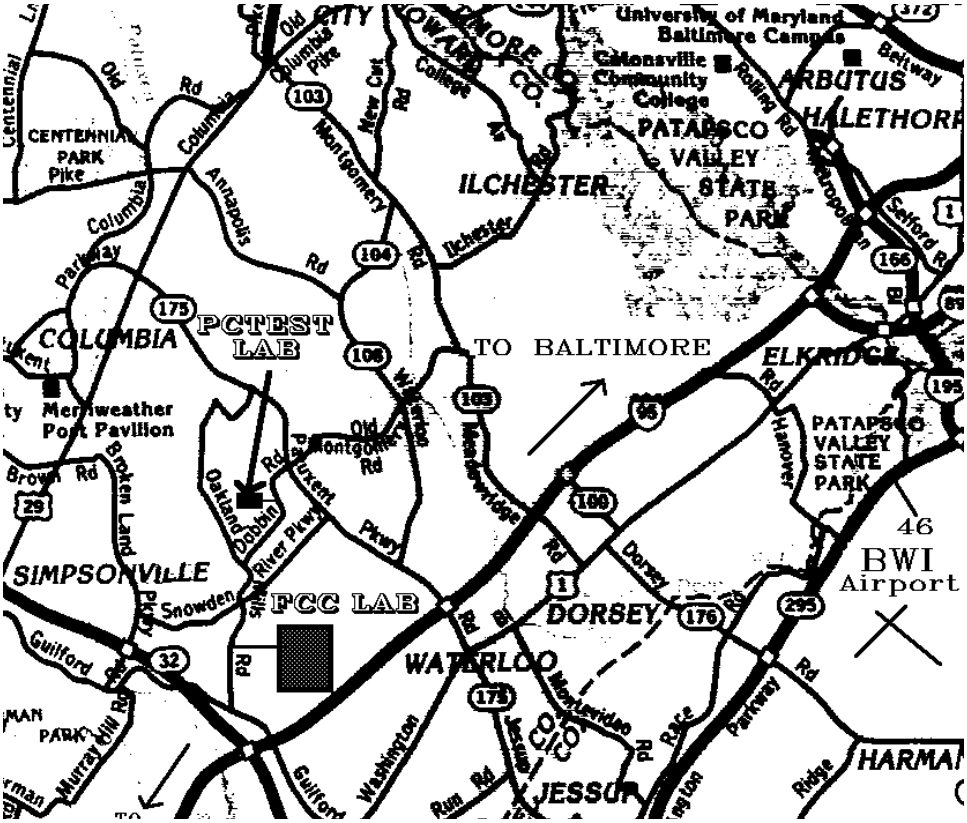


Fig. 1. The map above shows the Columbia vicinity area.
The map also shows PCTest Lab, FCC Lab and BWI airport. (Scale 1"=2miles)

Product Information

Equipment Description:

The Equipment Under Test (EUT) is the **ZOLTRIX, Inc. (Model: *FM-RIB3HC*) 16-Bit ISA Bus Data/Fax/Voice Modem Card FCC ID: H4TFM-RIB3HC**. The EUT features Speakerphone, and Personal Voice Messaging System.

Max. Baud Rate(s):	Data: 56,000 (Flex) bps (Data) Fax: 14,400 bps (Send/Receive)
Crystal/Oscillator(s):	28.224MHz
Chipset(s):	Rockwell RCVDL56DPGL/SP Rockwell 11229-14
External Port(s):	RJ-11C: Telephone Line connector RJ-11C: Telephone Handset connector Mini-jack: audio-IN Mini-jack: audio-OUT
Internal Port(s):	4-pin audio connector (x2)
Cable(s):	*Unshielded* Telco wires
Bus Compatibility:	16-Bit ISA Bus interface
Power Supply:	from host computer

EMI suppression device(s) installed in production:

* see schematics (Attachment G)

EMI suppression device(s) added and/or modified during testing:

* none

Description of Tests

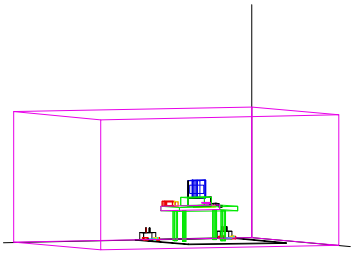


Fig. 2. Shielded Enclosure Line-Conducted Test Facility

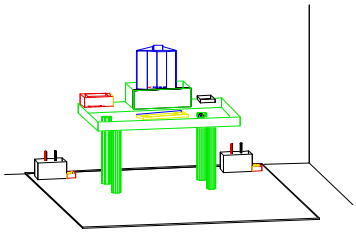


Fig. 3. Line-Conducted Emission Test Set-Up

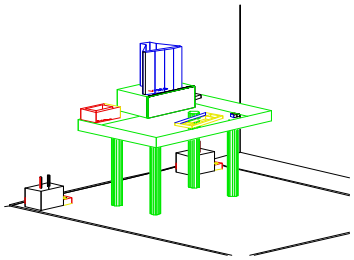


Fig. 4. Wooden Table & Bonded LISNs

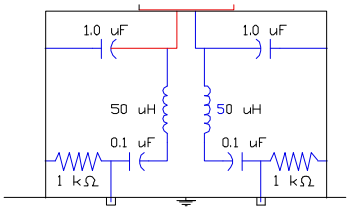


Fig. 5. LISN Schematic Diagram

Conducted Emissions

The line-conducted facility is located inside a 16'x20'x10' shielded enclosure. It is manufactured by Ray Proof Series 81 (Fig. 2). The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-6.
A 1m.x1.5m. wooden table 80 cm. high is placed 40cm. away from the vertical wall and 1.5m away from the side wall of the shielded room (Fig. 3). Solar Electronics and EMCO Model 3725/2 (10kHz-30MHz) 50 **W**/50 uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room (FIg. 4). The EUT is powered from the Solar LISN and the support equipment is powered from the EMCO LISN. Power to the LISNs are filtered by a high-current high-insertion loss Ray Proof power line filters (100dB 14kHz-10GHz). The purpose of the filter is to attenuate ambient signal interference and this filter is also bonded to the shielded enclosure. All electrical cables are shielded by braided tinned copper zipper tubing with inner diameter of 1/2". If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the Solar LISN. LISN schematic diagram is shown in Figure 5. All interconnecting cables more than 1 meter were shortened by non-inductive bundling (serpentine fashion) to a 1-meter length. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME from the EUT. The spectrum was scanned from 450 kHz to 30 MHz with 20 msec sweep time. The frequency producing the maximum level was reexamined using EMI/ Field Intensity Meter and Quasi-Peak adapter. The detector function was set to CISPR quasi-peak mode. The bandwidth of the receiver was set to 10 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission. Each emission was maximized by: switching power lines; varying the mode of operation or resolution, clock or data exchange speed; scrolling H pattern to the EUT and/or support equipment, and powering the monitor from the floor mounted outlet box and the computer aux AC outlet, if applicable; whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in Appendix C. Each EME reported was calibrated using the HP8640B signal generator.

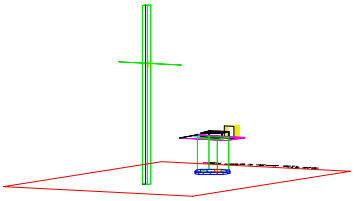


Fig. 6. 3-Meter Test Site

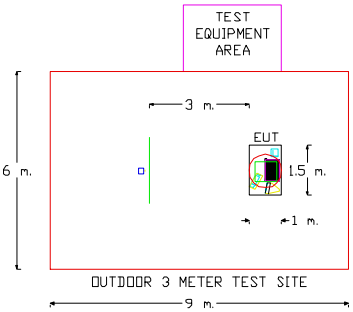


Fig. 7. Dimensions of Outdoor Test Site

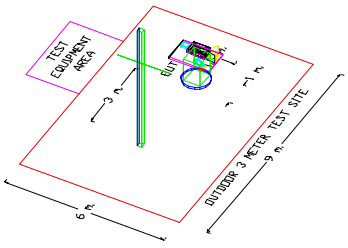


Fig. 8. Turntable and System Setup

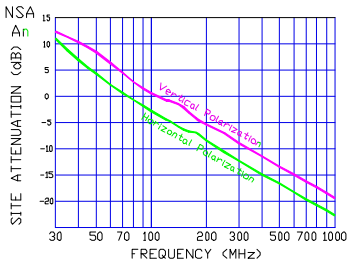


Fig. 9. Normalized Site Attenuation Curves (H&V)

Radiated Emissions

Preliminary measurements were made indoors at 1 meter using broadband antennas, broadband amplifier, and spectrum analyzer to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, turntable azimuth with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 to 200 MHz using biconical antenna and 200 to 1000 MHz using log-spiral antenna. Above 1 GHz, linearly polarized double ridge horn antennas are used.

Final measurements were made outdoors at 3-meter test range using Roberts™ Dipole antennas or horn antenna (see Figure 6). The test equipment was placed on a wooden and plastic bench situated on a 1.5 x 2 meter area adjacent to the measurement area (see Figure 7). Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined and investigated using EMI/Field Intensity Meter and Quasi-Peak Adapter. The detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 100 kHz or 1 MHz depending on the frequency or type of signal.

The half-wave dipole antenna was tuned to the frequency found during preliminary radiated measurements. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8-meter high non-metallic 1 x 1.5 meter table (see Figure 8). The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each EME emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by: varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and/or support equipment, and powering the monitor from the floor mounted outlet box and the computer aux AC outlet, if applicable; and changing the polarity of the antenna, whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in Appendix C. Each EME reported was calibrated using the HP8640B signal generator. The Theoretical Normalized Site Attenuation Curves for both horizontal and vertical polarization are shown in Figure 9.

Support Equipment Used

1. ALL PHASE Computer	FCC ID: MLFAPCS931014286 1.8 m. unshielded power cord	S/N: AP20521
ZOLTRIX Fax Modem	**FCC ID: H4TFM-RIB3HC**	**(EUT)**
Number Nine VGA Card	FCC ID: JF9-GXE64TRIOPCI	
2. NEC Monitor	FCC ID: A3DJC-1535VMA 1.8 m. unshielded power cord 1.0 m. shielded D-sub cable	S/N: 3V001
3. HP ThinkJet Printer	FCC ID: BS46XU2225C 1.8 m. unshielded AC power cord 1.0 m. shielded cable (bundled)	S/N: 2522S40719
4. MICROSOFT Mouse	FCC ID: C3KSS1 1.6 m. shielded cable	S/N: 03103564
5. LG Modem	FCC ID: BEJ3JXGSM2400 1.8 m. unshielded DC power cord 1.2 m. shielded cable	S/N: 001406
6. MAXISWITCH Keyboard	FCC ID: D7J2196001-XX 1.6 m. shielded cable	S/N: 0000187907
7. DUOFONE Phone	Model: 43-543 1.8 m. unshielded DC power cord 2.0 m. unshielded Telco cable	S/N: 030227
8. MICRO7 Line Simulator	Model: LS100-4 1.8 m. unshielded AC power cord 2.0 m. unshielded Telco cable	S/N: 7601869
9. REALISTIC Microphone	Model: 39-992D	1.6 m. shielded cable
10. LABTEC Speakers	Model: CS-150	1.2 m. unshielded cable

(See Appendix C - "Test Photographs" for actual system set-up.)

Test Data

Conducted Emissions

***

(See attached Plots - Next Pages)

NOTES:

1. ***All video modes and resolutions were investigated and the worst-case emissions are reported. See attached Plots.***
2. ***The limit for Class B digital device is 250μV from 450 kHz to 30 MHz.***
3. ***Line A = Phase Line B = Neutral***
4. ***Deviations to the Specifications: None***

* *All readings are calibrated by HP8640B signal generator with accuracy traceable to the National Institute of Standards and Technology (formerly NBS).*

** *Measurements using CISPR quasi-peak mode.*

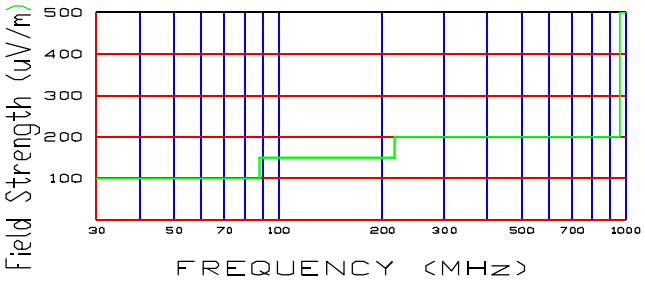
Test Data

Radiated Emission

******

Freq. (MHz)	Level* (dBm)	AFCL** (dB)	POL (H/V)	Height (m)	Azimuth (° angle)	F/S (µV/m)	Margin*** (dB)
60.2	- 75.0	4.9	V	2.9	230	70.2	- 3.1
120.4	- 79.5	11.5	V	2.3	70	89.1	- 4.5
270.0	- 83.0	19.5	V	1.6	180	150.0	- 2.5
300.0	- 87.0	20.6	V	1.5	310	107.2	- 5.4
360.0	- 88.0	22.6	V	1.4	180	119.9	- 4.4
434.1	- 88.1	24.5	V	1.3	210	148.2	- 2.6

Table 1. Radiated Measurements at 3-meters.



NOTES:

1. All modes of operation were investigated and the worst-case emissions are reported.

2. The radiated limits are shown on Figure 10. Above 1GHz the limit is 500µV/m.

Fig. 10. Limits at 3 meters

* *All readings are calibrated by HP8640B signal generator with accuracy traceable to the National Institute of Standards and Technology (formerly NBS).*

** *AFCL = Antenna Factor (Roberts Ô dipole) and Cable Loss (30 ft. RG58C/U).*

*** *Measurements using CISPR quasi-peak mode. Above 1GHz, peak detector function mode is used using a resolution bandwidth of 1MHz and a video bandwidth of 1MHz. The peak level complies with the average limit. Peak mode is used with linearly polarized horn antenna and low-loss microwave cable.*

Plot(s) of Conducted Emission

See Attachment D

Sample Calculations

dB μV = 20 log $_{10}$ (μV/m)

dB μV = dBm + 107

EX. 1.

@ 20.3 MHz Class B limit = 250 μV = 47.96 dBμV

Reading = –67.8 dBm (calibrated level)
convert to dbμV = –67.8 + 107 = 39.2 dBμV

$10^{(39.2/20)}$ = 91.2 μV

Margin = 39.2 – 47.96 = –8.76
8.8 dB below limit

EX. 2.

@ 568.3 MHz Class B limit = 200 μV/m = 46 dBμV/m

Reading = –92.2 dBm (calibrated level)
convert to dBμV/m = –92.2 + 107 = 14.8 dBμV/m
Antenna factor + Cable Loss = 27.5 dB
Total = 42.3 dBμV/m

Margin = 42.3 – 46.0 = –3.7
3.7 dB below the limit

Accuracy of Measurement

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994).

Contribution (Line Conducted)	Probability Distribution	Uncertainty (+/- dB)	
		9kHz-150MHz	150-30 MHz
Receiver specification	Rectangular	1.5	1.5
LISN coupling specification	Rectangular	1.5	1.5
Cable and input attenuator calibration	Normal (k=2)	0.3	0.5
Mismatch: Receiver VRC Γ_1=0.03 LISN VRC Γ_R=0.8 (9 kHz) 0.2 (30 MHz) Uncertainty limits 20Log(1 +/-$\Gamma_1\Gamma_R$)	U-Shaped	0.2	0.35
System repeatability	Std. deviation	0.2	0.05
Repeatablility of EUT		-	-
Combined standard uncertainty	Normal	1.26	1.30
Expanded uncertainty	Normal (k=2)	2.5	2.6

Calculations for 150 kHz to 30 MHz:

$$u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)} = \pm\sqrt{\frac{1.5^2+1.5^2}{3}+(\frac{0.5}{2})^2+\frac{0.05^2}{2}+0.35^2} = \pm 1.298 dB$$

$$U = 2U_c(y) = \pm 2.6 dB$$

Contribution (Radiated Emissions)	Probability Distribution	Uncertainties (+/-dB)	
		3 m	10 m
Ambient Signals		-	-
Antenna factor Calibration	Normal (k=2)	+/- 1.0	+/- 1.0
Cable loss Calibration	Normal (k=2)	+/- 0.5	+/- 0.5
Receiver specification	Rectangular	+/- 1.5	+/- 1.5
Antenna directivit	Rectangular	+ 0.5/-0	+ 0.5
Antenna factor variaton with height	Rectangular	+/- 2.0	+/- 0.5
Antenna phase centre variation	Rectangular	0.0	+/- 0.2
Antenna factor frequency interpolation	Rectangular	+/- 0.25	+/- 0.25
Measurement distance variation	Rectangular	+/- 0.6	+/- 0.4
Site imperfections	Rectangular	+/- 2.0	+/- 2.0
Mismatch: Receiver VRC Γ1= 0.2 Antenna VRC Γ_R = 0.67 (Bi) 0.3 (Lp) Uncertainty limits 20Log(1+/- $\Gamma_1\Gamma_R$)	U-Shaped	+ 1.1 - 1.25	+/- 0.5
System repeatability	Std. Deviation	+/- 0.5	+/- 0.5
Repeatability of EUT		-	-
Combined Standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

Calculations for 3m biconical antenna. Coverage factor of k=2 will ensure that the level of confidence will be approximately 95%, therefore:

$U = 2u_c(y) = 2 \times +/- 2.19 = +/-4.38$ dB

Test Equipment

Type	Model	Cal. Due Date	S/N
Microwave Spectrum Analyzer	HP8566B (100Hz-22GHz)	08/15/98	3638A08713
Microwave Spectrum Analyzer	HP8566B (100Hz-22GHz)	04/17/99	2542A11898
Spectrum Analyzer/Tracking Gen.	HP8591A (100Hz-1.8GHz)	08/10/98	3144A02458
Signal Generator*	HP8640B (500Hz-1GHz)	08/09/98	2232A19558
Signal Generator*	HP8640B (500Hz-1GHz)	08/09/98	1851A09816
Signal Generator*	Rohde & Schwarz (0.1-1000MHz)	09/11/98	894215/012
Ailtech/Eaton Receiver	NM37/57A-SL (30-1000MHz)	04/12/99	0792-03271
Ailtech/Eaton Receiver	NM37/57A (30-1000MHz)	03/11/99	0805-03334
Ailtech/Eaton Receiver	NM17/27A (0.1-32MHz)	09/17/98	0608-03241
Quasi-Peak Adapter	HP85650A	08/15/98	2043A00301
Ailtech/Eaton Adapter	CCA-7 CISPR/ANSI QP Adapter	03/11/99	0194-04082
RG58 Coax Test Cable	No. 167		n/a
Harmonic/Flicker Test System	HP 6841A (IEC 555-2/3)		3531A00115
Broadband Amplifier (2)	HP8447D		1145A00470, 1937A03348
Broadband Amplifier	HP8447F		2443A03784
Transient Limiter	HP11947A (9kHz-200MHz)		2820A00300
Horn Antenna	EMCO Model 3115 (1-18GHz)		9704-5182
Horn Antenna	EMCO Model 3115 (1-18GHz)		9205-3874
Horn Antenna	EMCO Model 3116 (18-40GHz)		9203-2178
Biconical Antenna (4)	Eaton 94455/Eaton 94455-1/Singer 94455-1/Compliance Design		1295, 1332, 0355
Log-Spiral Antenna (3)	Ailtech/Eaton 93490-1		0608, 1103, 1104
Roberts Dipoles	Compliance Design (1 set)		
Ailtech Dipoles	DM-105A (1 set)		33448-111
EMCO LISN	3816/2		1079
EMCO LISN	3816/2		1077
EMCO LISN	3725/2		2009
Microwave Preamplifier 40dB Gain	HP83017A (0.5-26.5GHz)		3123A00181
Microwave Cables	MicroCoax (1.0-26.5GHz)		
Ailtech/Eaton Receiver	NM37/57A-SL		0792-03271
Spectrum Analyzer	HP8594A		3051A00187
Spectrum Analyzer (2)	HP8591A		3034A01395, 3108A02053
Modulation Analyzer	HP8901A		2432A03467
NTSC Pattern GeneratorLeader	408		0377433
Noise Figure Meter	HP 8970B		3106A02189
Noise Figure Meter	Ailtech 7510		TE31700
Noise Generator	Ailtech 7010		1473
Microwave Survey Meter	Holaday Model 1501 (2.450GHz)		80931
Digital Thermometer	Extech Instruments 421305		426966
Attenuator	HP 8495A (0-70dB) DC-4GHz		
Bi-Directional Coax Coupler	Narda 3020A (50-1000MHz)		
Shielded Screen Room	RF Lindgren Model 26-2/2-0		6710 (PCT270)
Shielded Semi-Anechoic Chamber	Ray Proof Model S81		R2437 (PCT278)
Enviromental Chamber	Associated Systems Model 1025 (Temperature/Humidity)		PCT285

* Calibration traceable to the National Institute of Standards and Technology (NIST).

Test Software Used

```
10  CLS:COLOR 7,0
20  FOR I = 1 TO 80
30  PRINT ‘‘H’’;
40  NEXT I
50  FOR K= 1 TO 25
60  LPRINT ‘‘H’’;
70  NEXT K
80  OPEN ‘‘COM1:1200,N,8,1,CS0,DS0" FOR OUTPUT AS #1
90  PRINT#1,’’ATDT,0123456789"
100 CLOSE:GOTO 20
```

NOTE:
This is a sample of the basic program used during the test. However, during testing a different software program may be used; whichever determines the worst-case condition. In addition, the program used also depends on the number and type of devices being tested.

Actual program used is the ZOLTRIX software driver/program using Windows environment and exercising all ports.

Recommendation/Conclusion

The data collected shows that the **ZOLTRIX, Inc. (Model: *FM-RIB3HC*) 16-Bit ISA Bus Data/Fax/Voice Modem Card FCC ID: H4TFM-RIB3HC** complies with §§ 15.107 and 15.109 of the FCC Rules. The highest emission observed with a minimum margin to the specifications was at 17.245 MHz for conducted emissions with a margin of 5.2 dB, and at 434.1 MHz for radiated emissions with a margin of 2.6 dB.