ROGERS
Labs, Inc.

4405 West 259TH Terrace • Louisburg, KS 66053 • PHONE & FAX: (913) 837-3214

ENGINEERING TEST REPORT
FOR
FCC CERTIFICATION

ELECTROMAGNETIC INTERFERENCE TEST RESULTS
FOR
CFR 47, PART 15C - INTENTIONAL RADIATORS

For

DYNAMIC VOICE
10501 W. 84th Terrace
Lenexa, KS 66214-1643
Frank Parks,
Director of RF Technology

MODEL: FREEDOM MIC
Frequency 922-927.925 MHz
FCC ID#: JVN007

Test Date: June 11, 1999

Certification Date: June 11, 1999

Certifying Engineer: Scot D Rogers

Scot D. Rogers
ROGERS LABS, INC.
4405 West 259th Terrace
Louisburg, KS 66053
Phone: (913) 837-3214
FAX: (913) 837-3214

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FORWARD:

The following is submitted for consideration in obtaining a Grant of Certification for low power intentional radiators per CFR Paragraph 15.249.

Name of Applicant:

DYNAMIC VOICE
10501 W. 84th Terrace
Lenexa, KS 66214-1643

Model: FREEDOM MIC

FCC I.D.: JVN007

Frequency Range: 922-927.925 MHz

Operating Power: Less than 50 mV/m @ 3 Meters (94 dBμV/m @ 3 meters)

1) Applicable Standards & Test Procedures

a) In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 1998, Part 2, Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1031 through 2.1057, Part 15C Paragraph 15.249, and FCC Document FCC98-58 the following is submitted:

b) Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in the ANSI 63.4-1992 Document.

2.1033(b) Application for Certification

(1) Manufacturer: DYNAMIC VOICE
10501 W. 84th Terrace
Lenexa, KS 66214-1643

(2) Identification: Model: FREEDOM MIC
FCC I.D.: JVN007

(3) Instruction Book:

Refer to Exhibit for Instruction Manual.

(4) Description of Circuit Functions:

Refer to Exhibit for Circuit Description.

(5) Block Diagram with Frequencies:

Refer to Exhibit for Block Diagram.

(6) Report of Measurements:

Follows in this Report.

(7) Photos: Construction, Component Placement, etc.:

Refer to Appendix of this report for Photographs of equipment.

(8) No Peripheral Equipment Was Necessary.

(9) Transition Provisions of 15.37 are not being requested.

(10) Direct Sequence Spread Spectrum:

Not Applicable.

(11) Not Applicable. The EUT is not a Scanning Receiver.

2) Equipment Tested

EUT	FCC I.D.#
FREEDOM MIC	JVN007

3) Equipment Function and Testing Procedures

The EUT is a 922-927.925 MHz radio transceiver used in conjunction with a FCC approved base station. The FREEDOM MIC is a wireless microphone used for recording voice data to the base station, also referred to as a wireless dictation device. The base station is manufactured by Dynamic Voice (FCC ID: JVN-CSL9000B) with the transmitter operating over 905-911 MHz and the receiver operating over 922-927.925 MHz. The EUT has the capability to control the record or playback features of the base station along with choice of transmit and receive frequencies. The unit enables the user to record information and playback all or part of the data. An A/C adapter is available to recharge the battery contained in the unit. The unit is disabled while connected to the A/C adapter. Powerline conducted emissions measurements were made for completeness.

4) Equipment and Cable Configurations

Conducted Emission Test Procedure

The test setup, including the EUT, was arranged in a typical equipment configuration and placed on a 1 x 1.5-meter wooden bench, 0.8 meters high located in a screen room. The power lines of the system were isolated from the power source using a standard LISN with a 50-µHy choke. EMI was coupled to the spectrum analyzer through a 0.1 µF capacitor internal to the LISN. The LISN was positioned on the floor beneath the

wooden bench supporting the EUT. The power lines and cables were draped over the back edge of the table.

Radiated Emission Test Procedure:

The EUT was placed on a rotatable 1 x 1.5-meter wooden platform, 0.8 meters above the ground plane at a distance of 3 meters from the FSM antenna. EMI energy was maximized by equipment placement, raising and lowering the FSM antenna, changing the antenna polarization, and by rotating the turntable. Each emission was maximized before data was taken using a spectrum analyzer. Refer to photos in Appendix for EUT placement.

5) List of Test Equipment

A Hewlett Packard 8591EM Spectrum Analyzer was used as the measuring device for the emissions testing of frequencies below 1 GHz. A Hewlett Packard 8562A Spectrum Analyzer was used as the measuring device for testing the emissions at frequencies above 1 GHz. The analyzer settings used are described in the following table. Refer to Appendix for a complete list of Test Equipment.

HP 8591 EM ANALYZER SETTINGS		
CONDUCTED EMISSIONS:		
RBW	AVG. BW	DETECTOR FUNCTION
9 kHz	30 kHz	Peak / Quasi Peak
RADIATED EMISSIONS:		
RBW	AVG. BW	DETECTOR FUNCTION
120 kHz	300 kHz	Peak / Quasi Peak
HP 8562A ANALYZER SETTINGS		
RBW	VIDEO BW	DETECTOR FUNCTION
100 kHz	100 kHz	PEAK
1 MHz	1 MHz	Peak / Average

EQUIPMENT	MFG.	MODEL	CAL. DATES	DUE.
LISN	Comp. Design	1762	9/98	9/99
Antenna	ARA	BCD-235-B	9/98	9/99
Antenna	EMCO	3147	9/98	9/99
Antenna	EMCO	3143	4/99	4/00
Analyzer	HP	8591EM	6/98	6/99

6) Units of Measurements

Conducted EMI: Data is in dBµV; dB referenced to one microvolt.

Radiated EMI: Data is in dBµV/m; dB/m referenced to one microvolt per meter.

7) Test Site Locations

Conducted EMI: The AC powerline conducted emissions tests were performed in a shielded screen room located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS.

Radiated EMI: The radiated emissions tests were performed at Rogers Labs, Inc. 3 meters Open Area Test Site (OATS).

Site Approval: Refer to Appendix for FCC Site Approval Letter, Reference 31040/SIT 1300F2, Dated February 6, 1998.

8) SUBPART B – UNINTENTIONAL RADIATORS

Conducted EMI

The EUT was arranged in a typical equipment configuration and placed on a 1 x 1.5-meter wooden bench 80 cm above the conducting ground plane, floor of a screen room. The bench was positioned 40 cm away from the wall of the screen room. The LISN was positioned on the floor of the screen room 80-cm from the rear of the EUT. The power cord of the EUT was connected to the LISN. A second LISN was also positioned on the floor of the screen room and used to power the auxiliary equipment. EMI was coupled to the spectrum analyzer through a 0.1 μF capacitor, internal to the LISN. Power line conducted emissions testing was carried out individually for each current carrying conductor of the EUT. The excess length of lead between the system and the LISN receptacle was folded back and forth to form a bundle not exceeding 40 cm in length. The screen room, conducting ground plane, analyzer and LISN were bonded together to the protective earth ground. Preliminary testing was performed to identify the frequencies of the emissions, which had the highest amplitudes. The

cables were repositioned to obtain maximum amplitude of measured EMI level. Once the worst case configuration was identified, plots were made of the EMI from 0.15 MHz to 30 MHz then the data was recorded with maximum conducted emissions levels.

Radiated EMI

The EUT was arranged in a typical equipment configuration and operated through all of its various modes. Preliminary testing was performed in a screen room with the EUT positioned 1 meter from the FSM. Radiated emissions measurements were performed to identify the frequencies, which produced the highest emissions. Plots were made of the frequency spectrum from 30 MHz to 1000 MHz for the preliminary testing. The highest radiated emission was then re-maximized at this location before final radiated emissions measurements were performed. Final data was taken with the EUT located at the OATS at a distance of 3 meters between the EUT and the receiving antenna. The frequency spectrum from 30 MHz to 1000 MHz was searched for radiated emissions. Measured emission levels were maximized by EUT placement on the table, rotating the turntable through 360 degrees, varying the antenna height between 1 and 4 meters above the ground plane and changing antenna position between horizontal and vertical polarization. Antennas used were Broadband

Biconical from 30 to 200 MHz, Log Periodic from 200 MHz to 5 GHz, and or a Biconilog from 30 to 1000 MHz.

Sample Calculations:

RFS = Radiated Field Strength

dBµV/m @ 3m = dBµV + A.F. - Amplifier Gain

dBµV/m @ 3m = 35.0 + 15.2 - 35

= 15.2

Data: Conducted (6 Highest Emissions)

Frequency In MHz	Level L1 In dBµV	Level L2 in dBµV	FCC Limit in dBµV
.45	35.5	35.5	48.0
.52	31.1	35.4	48.0
.60	28.2	31.9	48.0
.82	26.1	25.6	48.0
.90	23.2	24.9	48.0
1.0	24.3	21.8	48.0

Other emissions present had amplitudes at least 10 dB below the limit.

Data: General Radiated (6 Highest Emissions)

Frequency in MHz	FSM Horz. (dBµV)	FSM Vert. (dBµV)	A.F. (dB/m)	Amp. Gain (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	FCC Class B Limit @ 3m (dBµV/m)
30.5	35.0	41.2	15.2	35	15.2	21.4	40.0
32.5	30.5	39.1	15.2	35	10.7	19.3	40.0
38.5	30.8	42.4	15.2	35	11.0	22.6	40.0
40.5	31.1	43.1	10.5	35	6.6	18.6	40.0
44.5	30.8	40.3	10.5	35	6.3	15.8	40.0
76.5	34.2	48.1	8.0	35	7.2	21.1	40.0

Other emissions present had amplitudes at least 10 dB below the limit.

Summary of Results for Conducted Emissions

The conducted emissions for the EUT meet the requirements for FCC Part 15B CLASS B Digital Devices. The EUT had a 12.5 dB minimum margin below the limit. Other emissions were present with amplitudes at least 10.0 dB below the limit.

Summary of Results for Radiated Emissions

The radiated emissions for the EUT meet the requirements for FCC Part 15B CLASS B Digital Devices. The EUT had a 17.4 dB minimum margin below the limit. Other emissions were present with amplitudes at least 10 dB below the limit.

Statement of Modifications

No modifications to the EUT were required for the unit to meet the FCC Part 15B CLASS B emissions standards. There were no deviations to the specifications.

9) Subpart C - Intentional Radiators

As per CFR Part 15, Subpart C. The following information is submitted:

15.203 Antenna Requirements

The unit is produced with a permanently attached antenna. The antenna is not replaceable or user serviceable. The requirements of 15.203 are met; there are no deviations or exceptions to the specification.

Restricted Bands of Operation Per 15.205

Spurious emissions falling in the restricted frequency bands of operation were measured at the OATS. The EUT utilizes frequency, determining circuitry, which generates harmonics falling in the restricted bands. Emissions were checked at the OATS, using appropriate antennas or pyramidal horns, amplification stages, and a spectrum analyzer. No other significant emission was observed which fell into the restricted bands of operation.

Data 15.205

Radiated Emissions In Restricted Bands:

Emission Frequency (MHz)	FSM Horz (dBµV)	FSM Vert (dBµV)	Ant. Factor (dB)	Amp. Gain (dB)	RFS Horz @ 3m (dBµV/m)	RFS Vert @ 3m (dBµV/m)	Limit @ 3m (dBµV/m)
2766.0	23.1	22.8	33.4	25	31.5	31.2	54
3688.0	26.1	23.3	38.3	25	39.4	36.6	54
4610.0	22.5	23.0	42.5	25	40.0	40.5	54

No other emissions found in the restricted bands.

Sample Calculations:

RFS (dBµV/m @ 3m) = FSM(dBµV) + A.F.(dB) - Gain(dB)
= 23.1 + 33.4 - 25
= 31.5

15.209 Radiated Emissions Limits; General Requirements

Radiated EMI

The EUT was arranged in a typical equipment configuration and operated through all of its various modes. Preliminary testing was performed in a screen room with the EUT positioned 1 meter from the FSM. Radiated emissions measurements were performed to identify the frequencies, which produced the highest emissions. Plots were made of the frequency spectrum from 30 MHz to 10,000 MHz for the preliminary testing. The highest radiated emission was then re-maximized at this location before final radiated emissions measurements were performed. Final data was taken with the EUT located at the open field test site at a distance of 3 meters between the EUT and the receiving antenna. The frequency spectrum from 30 MHz to 10,000 MHz was searched for radiated emissions. Measured emission levels were maximized by EUT placement on the table, rotating the turntable through 360 degrees, varying the antenna height between 1 and 4 meters above the ground plane and changing antenna polarization between horizontal and vertical. Antennas used were Broadband Biconical from 30 MHz to 200 MHz, Log Periodic from 200 MHz to 5 GHz, Biconilog from 30 MHz to 1000 MHz, and/or Pyramidal Horns from 4 GHz to 40 GHz.

Data 15.209:

General Radiated (6 Highest Emissions):

Frequency in MHz	FSM Horz. (dBµV)	FSM Vert. (dBµV)	A.F. (dB/m)	Amp. Gain (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	FCC Class B Limit @ 3m (dBµV/m)
30.5	35.0	41.2	15.2	35	15.2	21.4	40.0
32.5	30.5	39.1	15.2	35	10.7	19.3	40.0
38.5	30.8	42.4	15.2	35	11.0	22.6	40.0
40.5	31.1	43.1	10.5	35	6.6	18.6	40.0
44.5	30.8	40.3	10.5	35	6.3	15.8	40.0
76.5	34.2	48.1	8.0	35	7.2	21.1	40.0

Other emissions present had amplitudes at least 10 dB below the limit.

Sample Calculations:

RFS = Radiated Field Strength

dBµV/m @ 3m = dBµV + A.F. - Amplifier Gain

dBµV/m @ 3m = 35.0 + 15.2 - 35

= 15.2

Summary of Results for Radiated Emissions:

The radiated emissions for the EUT meet the requirements for FCC Part 15C Intentional Radiators. The EUT had a 17.4 dB minimum margin below the limits. Other emissions were present with amplitudes at least 10 dB below the FCC Limits.

15.249 Operation in the Band 902-928 MHz

The power output was measured on an open field test site @ 3 meters. Data was taken per Paragraph 2.1046(a) and 15.249.

(a) The EUT was placed on a wooden turntable 0.8 meters above the ground plane and at a distance of 3 meters from

the FSM antenna. The amplitude of the carrier frequency was measured using a spectrum analyzer. The amplitude of the emission was then recorded from the analyzer display.

(b) Emissions radiated outside of the specified bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in 15.209, whichever is the lesser attenuation. The amplitudes of each spurious emission were measured at a distance of 3 meters from the FSM antenna at the OATS. The amplitude of each spurious emission was maximized by varying the FSM antenna height, polarization, and by rotating the turntable. A Biconilog Antenna was used for measuring emissions from 30 to 1000 MHz, a Log Periodic Antenna for 200 to 5000 MHz, Pyramidal Horn Antennas from 4 GHz to 40 GHz. Emissions were measured in dBμV/m @ 3 meters.

Emission Frequency (MHz)	FSM Horz. (dBμV)	FSM Vert. (dBμV)	Ant. Factor (dB)	Amp. Gain (dB)	RES Horz. @ 3m (dBμV/m)	RES Vert. @ 3m (dBμV/m)	Limit @ 3m (dBμV/m)
922.000	72.0	84.8	22.6	25	69.6	82.4	94
925.175	71.5	85.3	22.6	25	69.1	82.9	94
927.900	70.3	85.5	22.6	25	67.9	83.1	94

Note: Level was measured @ 3 meter site.

dBμv/m@ 3m = FSM + A.F. - AMP. GAIN
= 72.0 + 22.6 - 25
= 69.6

$\mu V/M = 10^{((dB\mu v/M)/20)}$
= 3,020.0

Refer to Figures showing plots taken in the screen room from the spectrum analyzer at a distance of 1 meter. The band edges are protected due to the frequency band of operation.

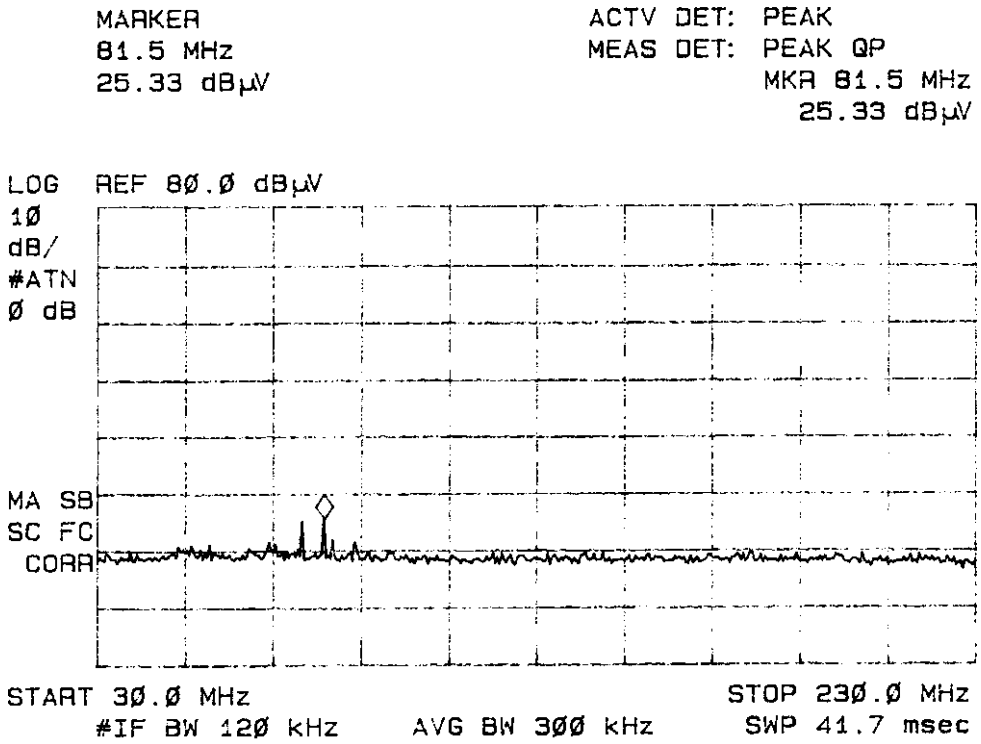

Figure 1 Emissions @ 1 Meter in Screen Room

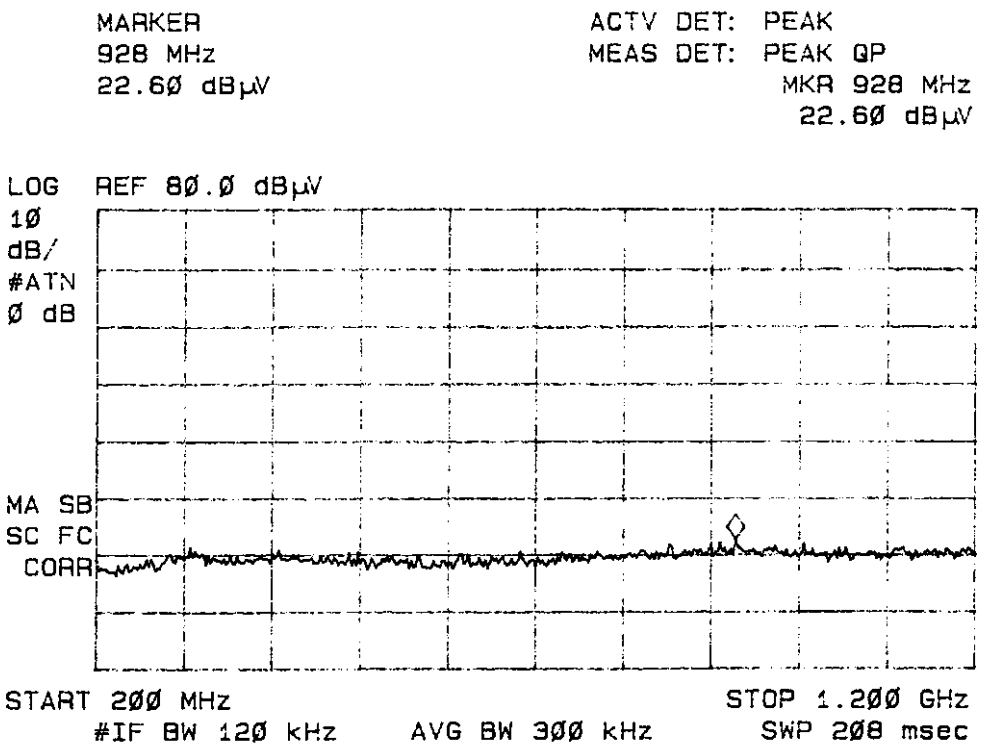

Figure 2 Emissions @ 1 Meter in Screen Room

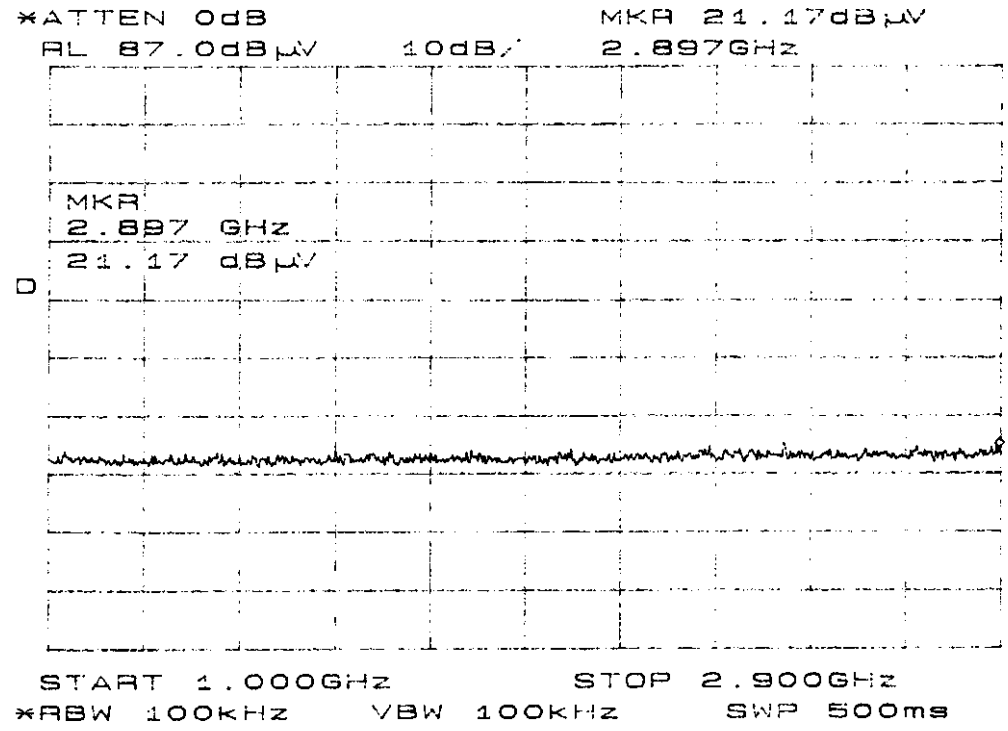

Figure 3 Emissions @ 1 Meter in Screen Room

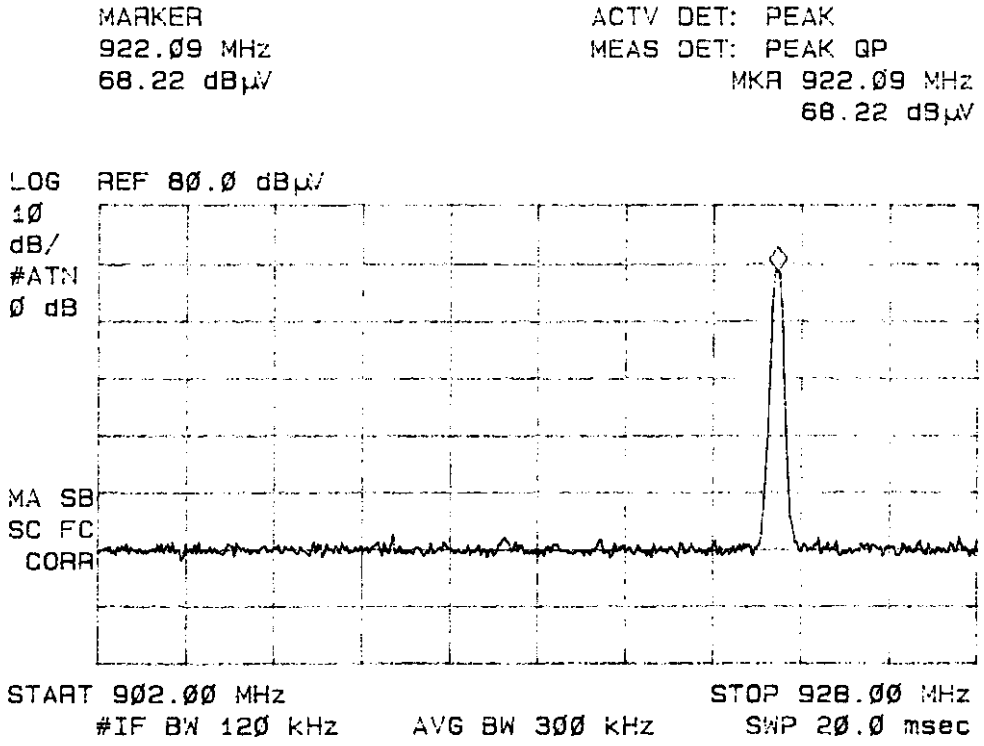

Figure 4 Emissions @ 1 Meter in Screen Room

Radiated Emissions of Intentional Radiator

The EUT had a 10.9 dB margin below the limits. The radiated emissions for the EUT meet the requirements for FCC Part 15C Intentional Radiators. There are no measurable emissions in the restricted bands other than those recorded in this report. Other emissions were present with amplitudes at least 10 dB below the FCC Limits. The specification of 15.249 are met, there are no deviations or exceptions to the requirements.

Statement of Modifications

No modifications to the EUT were required for the unit to meet the FCC Part 15B CLASS B emissions standards. There were no deviations to the specifications.

APPENDIX

Model: FREEDOM MIC

1. Photos of Conducted Emissions Test Set Up
2. Photos of Radiated Emissions Test Set Up
3. Photos of Case Front and Back
4. Photo Inside of Case
5. Photos RF PC Board
6. Photo FCC ID Label Location
7. Rogers Qualifications
8. Test Equipment List
9. FCC Site Approval Letter

TEST EQUIPMENT LIST FOR ROGERS LABS, INC.

The equipment is used daily and kept in good calibration and operating condition. Calibration of critical items are checked for accuracy each time used.

List of Test Equipment:	Calibration Date:
Scope: Tektronix 2230	2/99
Wattmeter: Bird 43 with Load Bird 8085	2/99
Power Supplies: Sorensen SRL 20-25, DCR 150, DCR 140	2/99
H/V Power Supply: Fluke Model: 408B (SN: 573)	2/99
R.F. Generator: Boonton 102F	2/99
R.F. Generator: HP 606A	2/99
R.F. Generator: HP 8614A	2/99
R.F. Generator: HP 8640B	2/99
Spectrum Analyzer: HP 8562A, Mixers: 11517A, 11980A & 11980K HP Adapters: 11518, 11519, 11520	2/99
Spectrum Analyzer: HP 8591 EM	6/98
Frequency Counter: Weston 1255	2/99
Frequency Counter: Leader LDC 825	2/99
Antenna: EMCO Log Periodic	9/98
Antenna: BCD 235/BNC Antenna Research	9/98
Antenna: EMCO Dipole Set 3121C	2/99
Antenna: C.D. B-100	2/99
Antenna: Solar 9229-1 & 9230-1	2/99
Antenna: EMCO 6509	2/99
Microline Freq. Meter: Model 27B	2/99
Dana Modulation Meter: Model 9008	2/99
Audio Oscillator: H.P. 200CD	2/99
R.F. Power Amp 65W Model: 470-A-1000	9/97
R.F. Power Amp 50W M185- 10-500	9/97
R.F. PreAmp CPPA-102	9/97
Shielded Room 5 M x 3 M x 3.0 M (100 dB Integrity)	
LISN 50 µHy/50 ohm/0.1 µf	9/98
LISN Compliance Eng. 240/20	2/99
SCS Power Amp Model: 2350A	2/99
Power Amp A.R. Model: 10W 1000M7	2/99
Power Amp EIN Model: A300	1/99
Linear Amp Mini Circuits: ZHL-1A (2 Units)	2/99
Combiner Unit Mini Circuits: ZSC-2-1 (2 Units)	2/99
ELGAR Model: 1751	2/99
ELGAR Model: TG 704A-3D	2/99
ELGAR Model: 400SD (PB)	2/99
ESD Test Set 2000i	10/95
Fast Transient Burst Generator Model: EFT/B-100	10/95
Current Probe: Singer CP-105	8/97
Current Probe: Solar 9108-1N	8/97
Field Intensity Meter: EFM-018	10/95

03/01/99

QUALIFICATIONS

Of

SCOT D. ROGERS, ENGINEER

ROGERS LABS, INC.

Mr. Rogers has approximately 12 years experience in the field of electronics. Six years working in the automated controls industry and 6 years working with the design, development and testing of radio communications and electronic equipment.

POSITIONS HELD:

Systems Engineer:	A/C Controls Mfg. Co., Inc. 6 Years
Electrical Engineer:	Rogers Consulting Labs, Inc. 5 Years
Electrical Engineer:	Rogers Labs, Inc. Current

EDUCATIONAL BACKGROUND:

1) Bachelor of Science Degree in Electrical Engineering from Kansas State University.

2) Bachelor of Science Degree in Business Administration Kansas State University.

3) Several Specialized Training courses and seminars pertaining to Microprocessors and Software programming.

Scot D Rogers

Scot D. Rogers

6/28/99

Date

1/11/99

FEDERAL COMMUNICATIONS COMMISSION

7435 Oakland Mills Road
Columbia, MD 21046
Telephone: 301-725-1585 (ext-218)
Facsimile: 301-344-2050

February 6, 1998

IN REPLY REFER TO
31040/SIT
1300F2

Rogers Labs, Inc.
4405 West 259th Terrace
Louisburg, KS 66053

Attention: Scot D. Rogers

Re: Measurement facility located at above address
(3 and 10 meter site)

Gentlemen:

Your submission of the description of the subject measurement facility has been reviewed and found to be in compliance with the requirements of Section 2.948 of the FCC Rules. The description has, therefore, been placed on file and the name of your organization added to the Commission's list of facilities whose measurement data will be accepted in conjunction with applications for certification or notification under Parts 15 or 18 of the Commission's Rules. Our list will also indicate that the facility complies with the radiated and AC line conducted test site criteria in ANSI C63.4-1992. Please note that this filing must be updated for any changes made to the facility, and at least every three years the data on file must be certified as current.

Per your request, the above mentioned facility has been also added to our list of those who perform these measurement services for the public on a fee basis. This list is updated monthly and is available on the Laboratory's Public Access Link (PAL) at 301-725-1072, and also on the Internet at the FCC Website www.fcc.gov/oet/info/database/testsite/.

Sincerely,

Thomas W. Phillips
Electronics Engineer
Customer Service Branch