FCC CERTIFICATION REPORT

ELECTROMAGNETIC INTERFERENCE TEST RESULTS
For CFR 47 Part 15B
Intentional Radiators

FOR

CONTER MFR. AND SUPPLY/USA

4200 W. 83rd St., Suite 203
Shawnee Mission, KS 66208
Phone: (913) 649-3589

Edmund Chow,
President

MODEL: WAVE 2000
FCC ID: OG8 PROFMWAVE

Test Date: March 2, 1999

Certification Date: March 2, 1999

Certifying Engineer: _____

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

TABLE OF CONTENTS

FORWARD:
The following is submitted for consideration in obtaining a Grant of Certification for low power intentional radiators.

Name of Applicant:

CONTER MFR. AND SUPPLY/USA
4200 W. 83rd St., Suite 203
Shawnee Mission, KS 66208
Model: WAVE 2000

FCC I.D.: OG8 PROFMWAVE

Frequency Range: 88.1-107.9 MHz

Operating Power: 250 µV/m @ 3 Meters

Applicable Standards & Test Procedures

a) In accordance with Part 1, Subpart G, Paragraphs 1.1103; Part 2, Subpart J, Paragraphs 2.907, 2.925, 2.926, 2.1031 through 2.1043; and Part 15, Subpart B, Paragraphs 15.19(A)(3), 15.21, 15.31, 15.33, 15.35, 15.201 (B), 15.203, 15.204(C), 15.205, 15.207(A), 15.209(A), and 15.239 of the Code of Federal Regulations, dated October 1, 1997 and FCC 98-58. The transition provisions in Paragraph 15.37 are not being requested.

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: CONTER MFG. & SUPPLY/USA
4200 W. 83RD Street, Suite 203
Shawnee Mission, KS 66208

(2) Identification: Model: WAVE 2000
FCC I.D.: OG8 PROFMWAVE

(3) Instruction Book:

Draft Instruction Manual attached.

(4) Description of Circuit Functions:

Device Operation:

The VTX434LPC is a low power FM transmitter.

Antenna and Ground plane:

(5) Block Diagram with Frequencies:

(6) Report of Measurements:

Follows in this Report.

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

Refer to Appendix.

(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.

Equipment Tested

EUT	FCC I.D.#
WAVE 2000	OG8 PROFMWAVE

Equipment Function and Testing Procedures

The EUT is a multi-channel transmitter operating in the FM radio band. The units allow a message, recorded or live, to be broadcast to a FM receiver in close proximity. The unit is targeted to broadcast into a parking lot local information or business announcement. Other applications are possible. The design of the system allows for the use of FM channels not currently in use in the target area.

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.

List of Test Equipment

A Hewlett Packard 8591EM Spectrum Analyzer was used as the measuring device for the emissions testing of frequencies below 1.8 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	5/98	5/99
Analyzer	HP	8591EM	5/98	5/99

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.

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.

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. Removal of the antenna inhibits the transmitter ability to broadcast. 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 (6 Highest Emissions):

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)
278.1	40.9	37.6	13.5	35	19.4	16.1	46
1019.7	38.6	37.3	23.1	25	36.7	35.4	54
1112.4	35.5	36.2	23.1	25	33.6	34.3	54
1205.1	36.3	36.5	23.1	25	34.4	34.6	54
1390.5	33.5	34.8	24.1	25	32.6	33.9	54
1483.2	33.2	35.7	25.3	25	33.5	36.0	54

No other emissions found in the restricted bands.

Sample Calculations:

Computed Peak (dBµV/m @ 3m) = FSM (dBµV) + A.F. (dB) - Gain (dB)
= 40.9 + 13.5 - 35
= 19.4

15.207 Conducted limits

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. 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.

Data 15.207:

Conducted (6 Highest Emissions) 15.207

Frequency in MHz	Level L1 in dBµV	Level L2 in dBµV	Limit in dBµV
.45	27.7	27.0	48.0
.50	28.7	26.0	48.0
.60	26.3	24.7	48.0
12.0	24.0	22.8	48.0
24.0	34.7	36.9	48.0
29.1	25.5	25.4	48.0

Other emissions were present with amplitudes at least 10 dB below limits.

Summary of results for Conducted Emissions:

The Conducted Emissions for the EUT meets the requirements for FCC Part 15C Intentional Radiators. The EUT had an 11.1 dB minimum margin below the limits. Other emissions were present with amplitudes at least 10 dB below the FCC Limits.

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 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 open field test site 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, changing cable location, 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 and/or Biconilog from 30 MHz to 1000 MHz.

Data 15.209:

Radiated (6 Highest Emissions) 15.209

Emission Freq. (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)
36.0	50.3	50.5	16.3	35	31.6	31.8	40.0
48.5	47.6	47.2	11.7	35	24.3	23.9	40.0
72.5	39.9	52.6	8.2	35	13.1	25.8	40.0
134.5	41.6	47.8	9.7	35	16.3	22.5	43.5
172.5	51.9	38.5	9.9	35	26.8	13.4	43.5
176.5	37.6	40.3	9.9	35	12.5	15.2	43.5

Other emissions were present with amplitudes at least 10 dB below limits.

Sample Calculations:

RFS = Radiated Field Strength

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

dBµV/m @ 3m = 50.3 + 16.3 - 35

= 31.6

Summary of Results for Radiated Emissions:

The radiated emissions for the EUT meet the requirements for FCC Part 15C Intentional Radiators. The EUT had an 8.2 dB minimum margin below the limits. Other emissions were present with amplitudes at least 10 dB below the FCC Limits.

15.239 Operation in the Band 88-108 MHz

(a) Emissions from the intentional radiator shall be confined within a band 200 kHz wide centered on the operating frequency. The 200 kHz band shall lie wholly within the frequency range of 88-1-8 MHz. The EUT only tunes 88.1-107.9 MHz and the emissions

meet the 200 kHz wide band restriction. Therefore, the requirements are met. There are no deviations or exceptions to the specification.

(b) The field strength of any emission within the permitted 200 kHz band shall not exceed 250 micro volts/meter at 3 meters. The emission limit in this paragraph is based on measuring equipment employing an average detector. Emissions were measured and data recorded for this report. No emission was measured above the limitations of this part. Therefore, the requirements are satisfied. There are no deviations or exceptions to the specifications.

(c) The field strength of any emissions radiated on any frequency outside of the 200 kHz band shall not exceed the general radiated emission limits in 15.209. Emissions were measured and data recorded for this report. No emission was measured above the limitations of this part. Therefore, the requirements are satisfied. The requirements of 15.209 are met; there are no deviations or exceptions to the specification.

Data 15.239:

Intentional and Spurious Emissions:

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)
92.7	69.5	69.7	8.8	35	43.3	43.5	43.5
185.4	37.7	47.0	9.9	35	12.6	21.9	43.5
278.1	40.9	37.6	13.5	35	19.4	16.1	46.0
370.8	34.4	39.9	15.6	35	15.0	20.5	46.0
463.5	36.1	38.2	17.0	35	18.1	20.2	46.0
556.2	40.4	42.7	18.6	35	24.0	26.3	46.0
648.9	32.0	32.9	20.5	35	17.5	18.4	46.0
741.6	32.0	31.8	20.7	35	17.7	17.5	46.0
105.1	69.7	70.0	8.5	35	43.2	43.5	43.5
210.2	35.1	49.6	10.6	35	10.7	25.2	43.5
315.3	43.2	40.8	15.3	35	23.5	21.1	46.0
420.4	35.1	36.5	16.1	35	16.2	17.6	46.0
525.5	34.3	39.8	18.1	35	17.4	22.9	46.0
630.6	33.9	37.5	20.0	35	18.9	22.5	46.0
735.7	32.6	33.1	21.2	35	18.8	19.3	46.0

Other emissions were present with amplitudes at least 10 dB below limits.

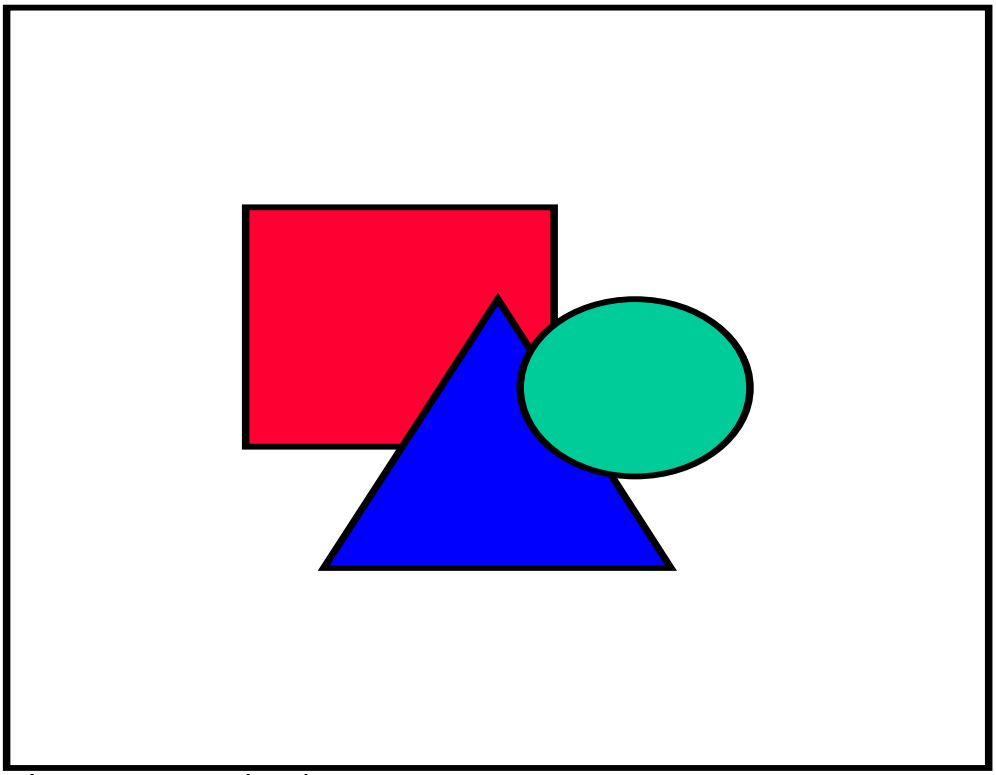


Figure 1 Band Edges

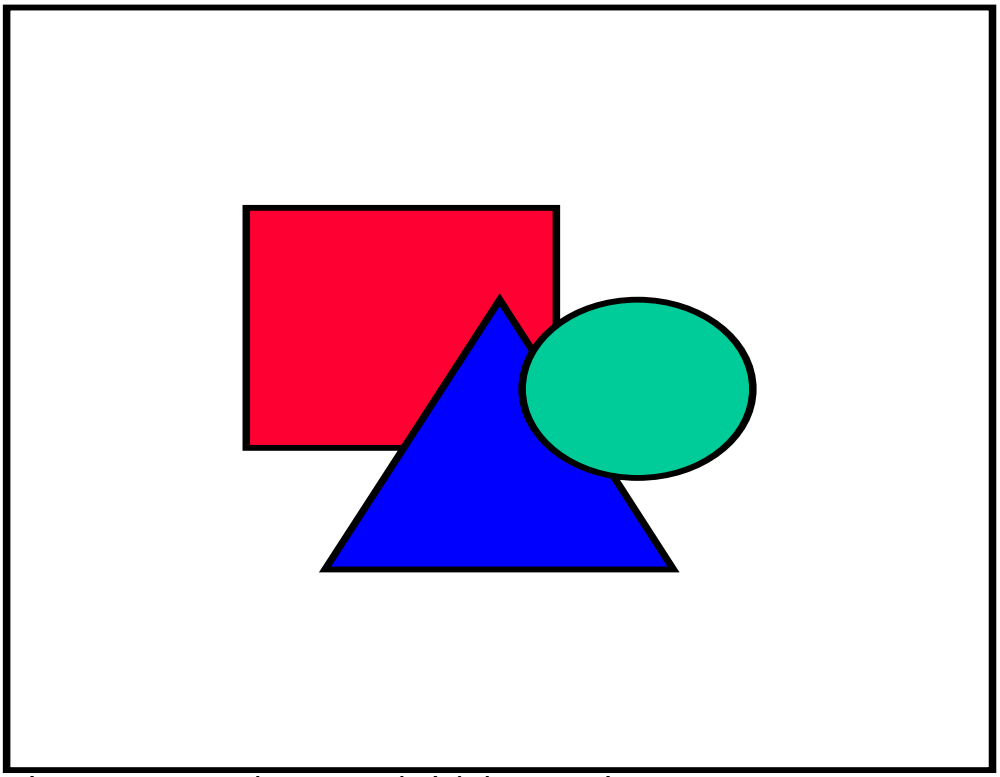


Figure 2 200 kHz Bandwidth requirement

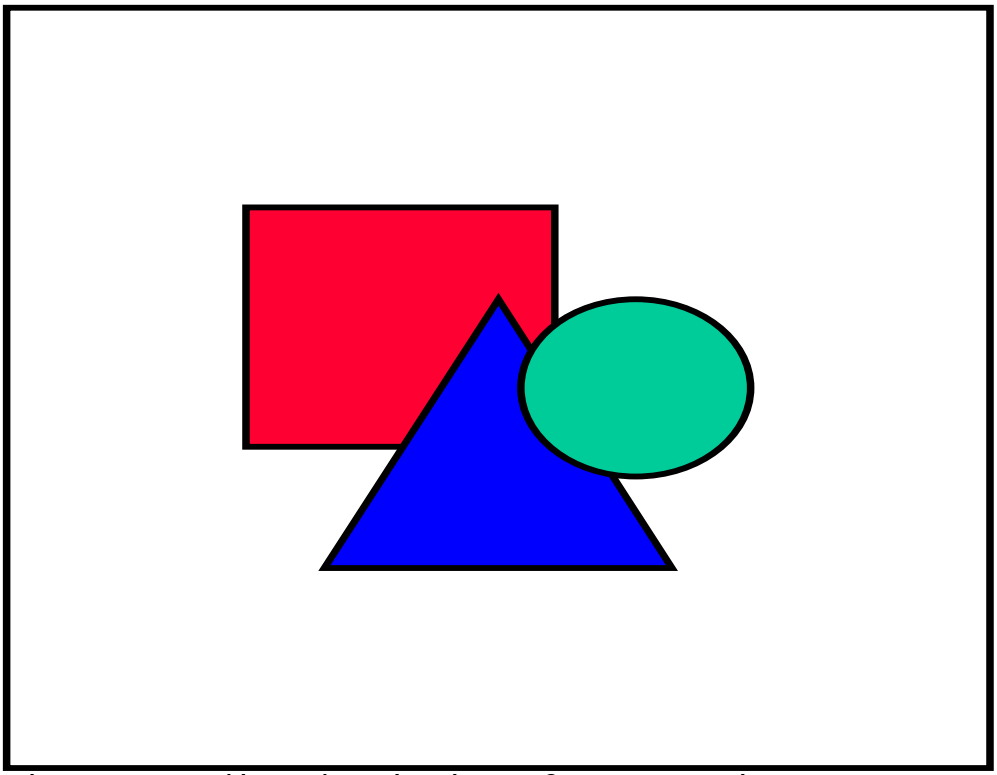


Figure 3 Radiated Emissions @ 1 Meter in Screen Room

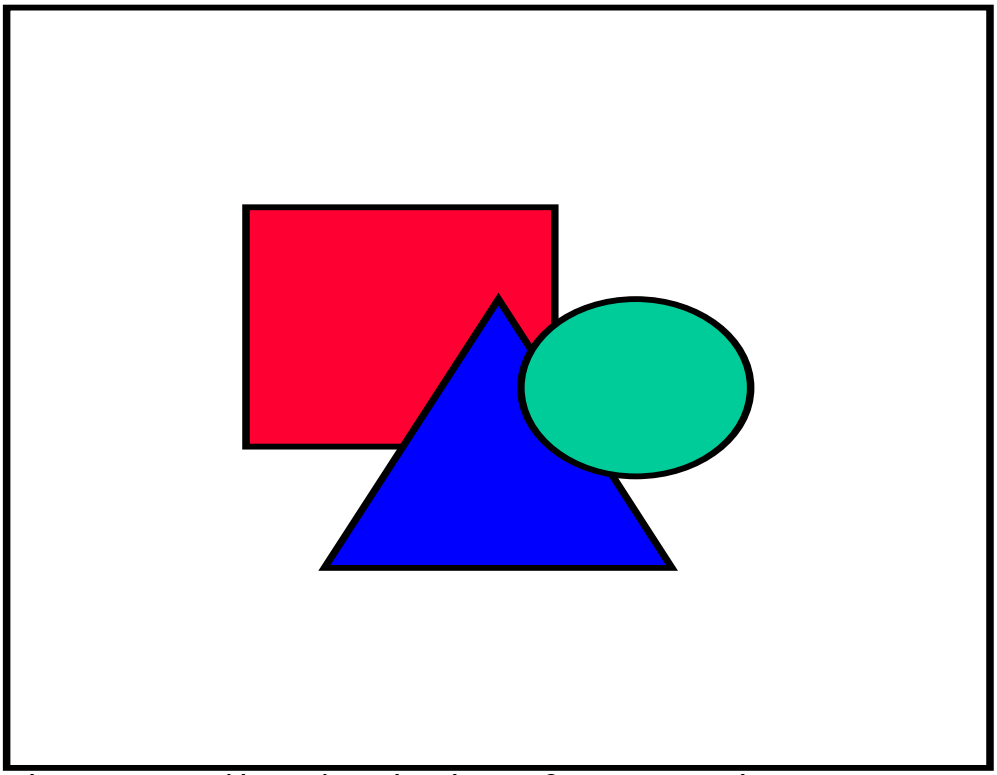


Figure 4 Radiated Emissions @ 1 Meter in Screen Room

SUMMARY OF RESULTS

Radiated Emissions:

The EUT had a 0-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.

Statement of Modifications:

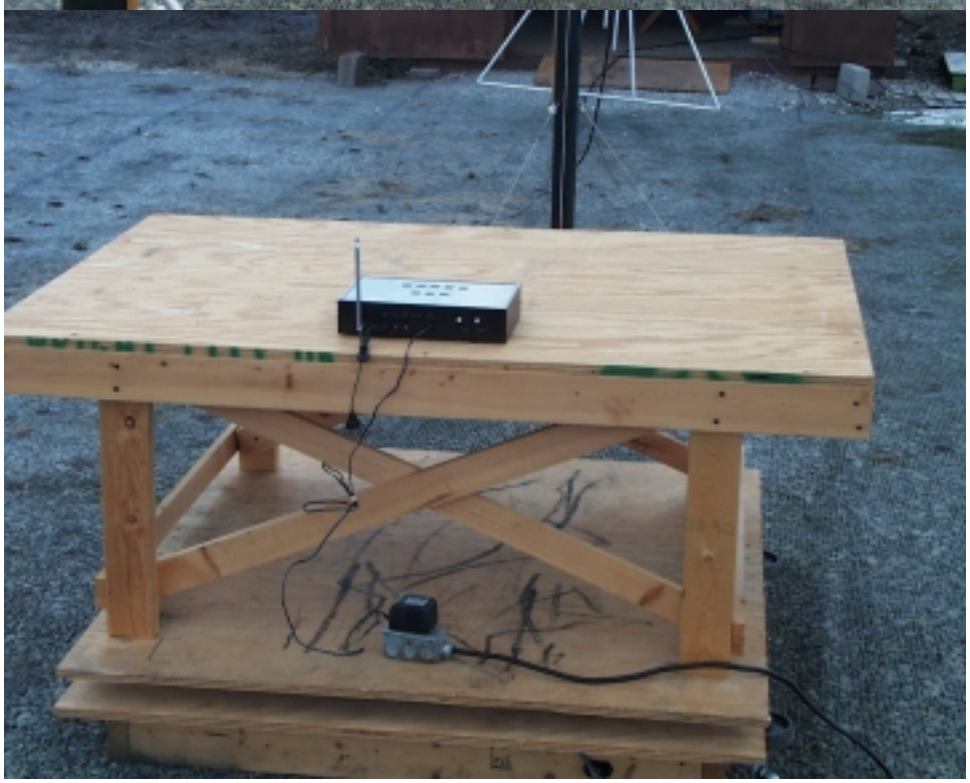
A voltage divider network was connected between the circuit output point and the antenna connection to reduce output level to meet FCC limits. This modification will be implemented into production units prior to release of the product. No other modifications to the EUT were required for the unit to meet the FCC, Parts 15B & 15C, Class B Emissions Standards. There were no deviations to the specifications.

APPENDIX

1) Photos Conducted
2) Photos Radiated
3) Photos Case Front and Back
4) Photos Inside Case
5) Photos RF PC Boards Front and Back
6) Photos Audio Amp PC Board Front and Back
7) Photos Display PC Board Front and Back
8) Photo Label Location
9) Test Equipment List
10) Rogers Qualifications
11) FCC Site Approval Letter

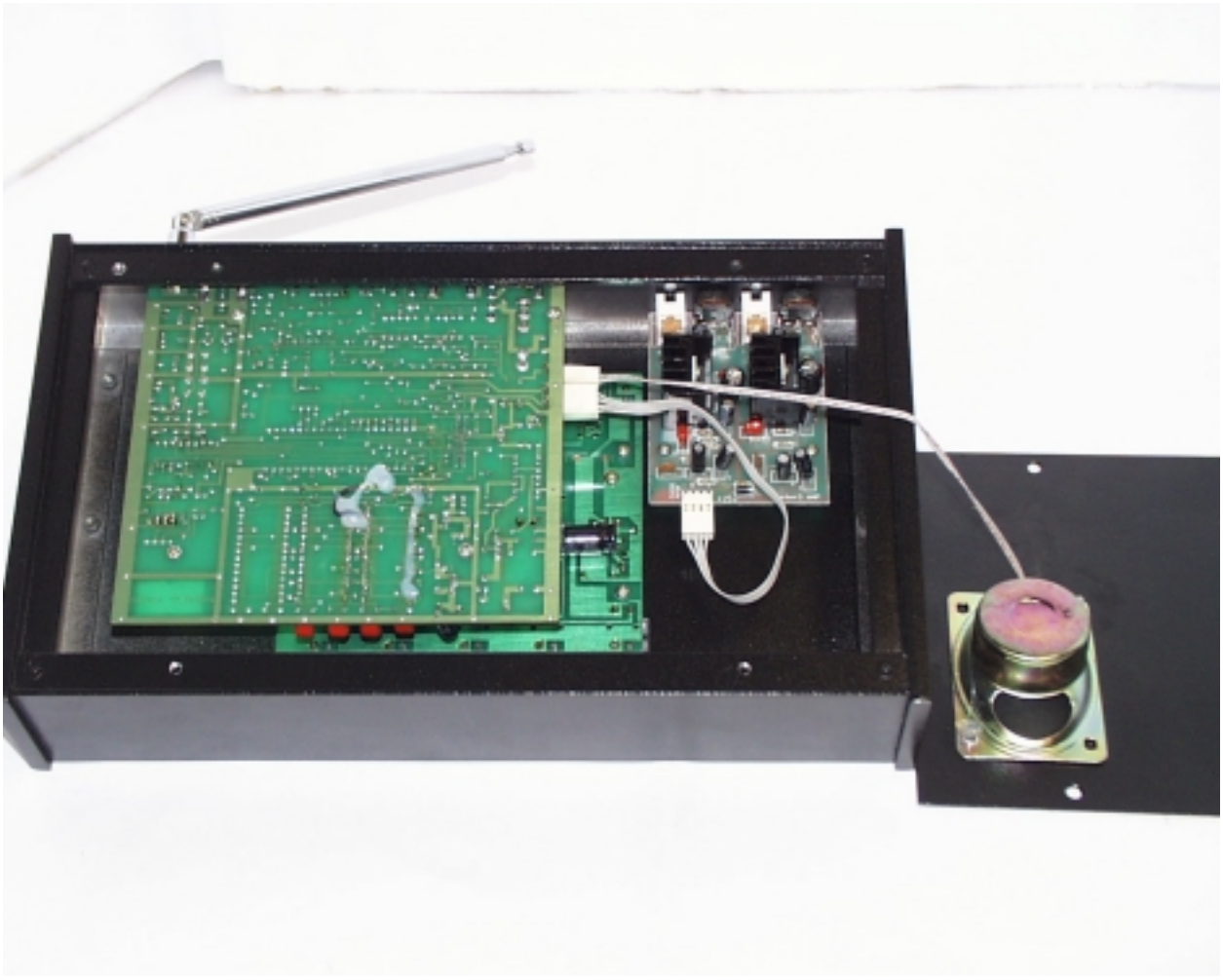
CONTER MFR. AND SUPPLY/USA
MODEL: WAVE 2000
PHOTOS CONDUCTED TEST SET UP

CONTER MFR. AND SUPPLY/USA
MODEL: WAVE 2000
PHOTOS RADIATED TEST SET UP

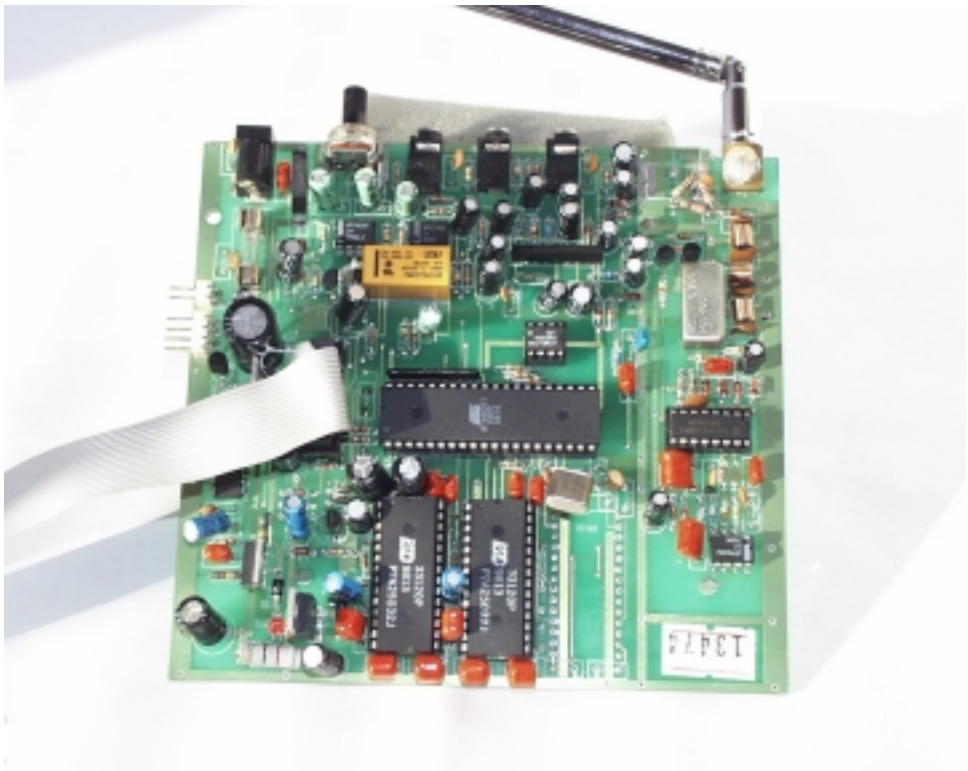


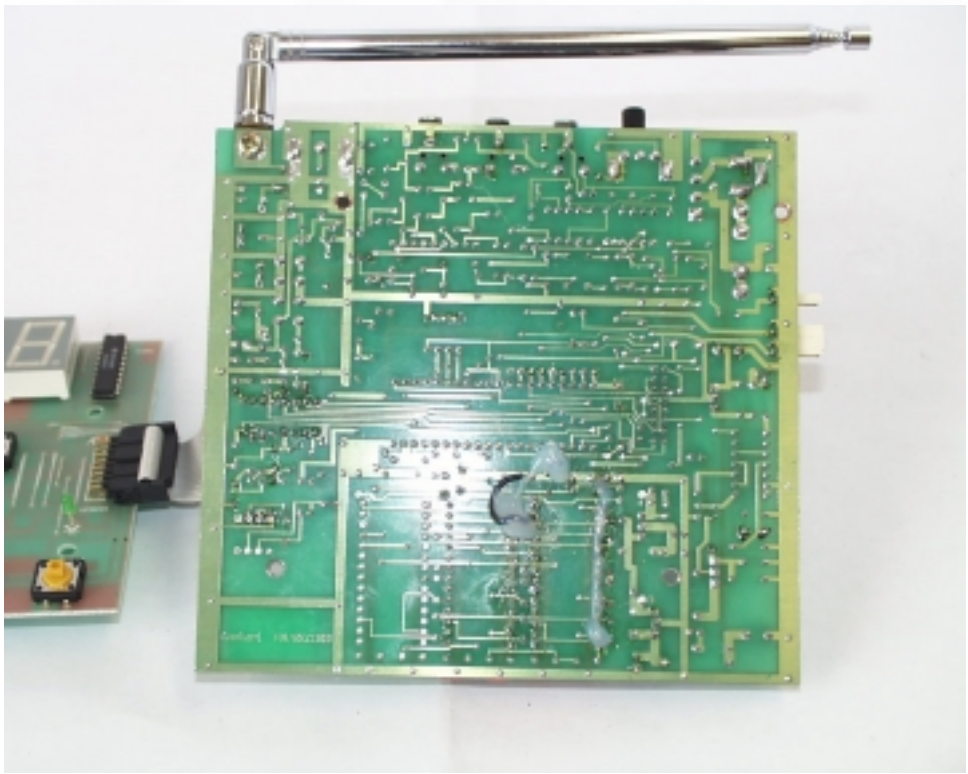
CONTER MFR. AND SUPPLY/USA
MODEL: WAVE 2000
PHOTOS FRONT AND BACK

CONTER MFR. AND SUPPLY/USA
MODEL: WAVE 2000
PHOTO INSIDE CASE

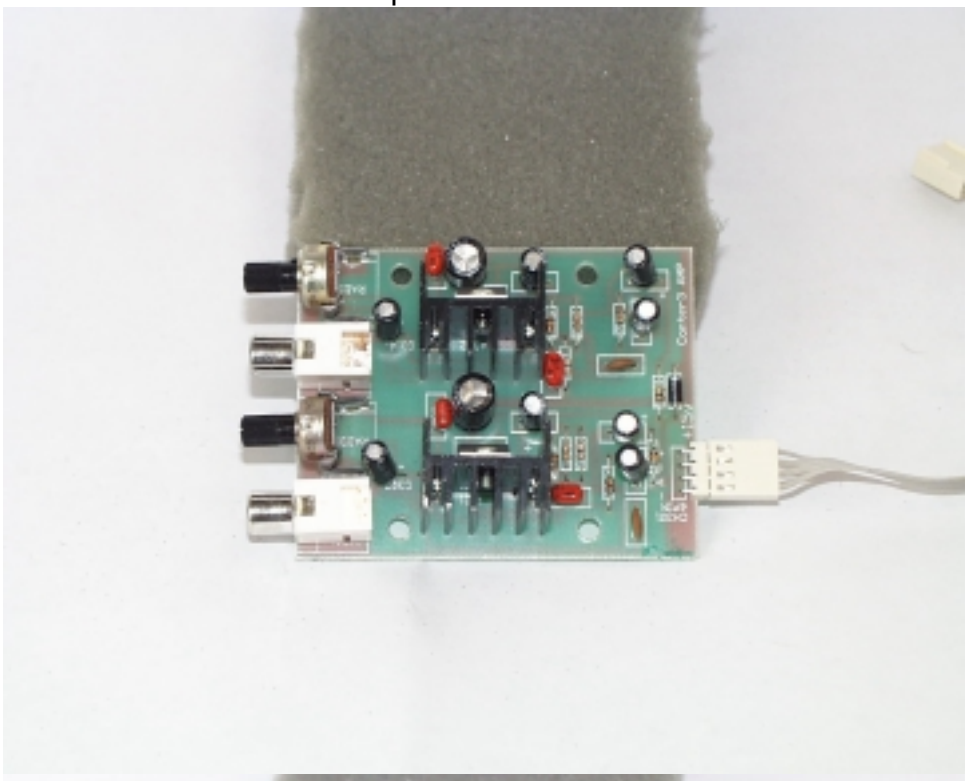


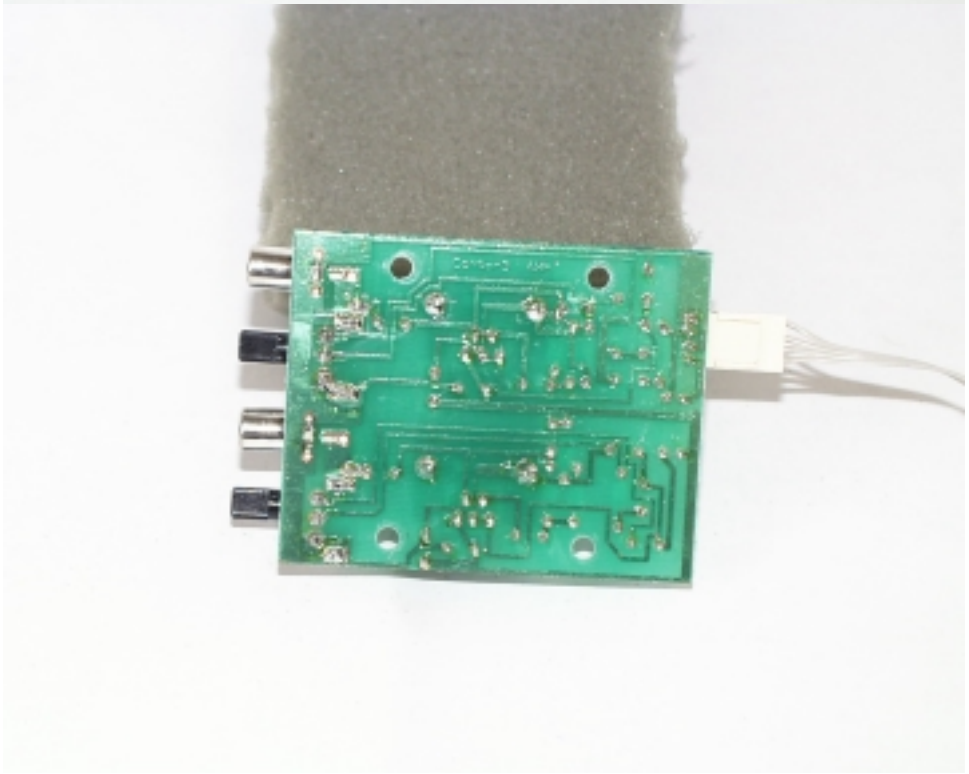
CONTER MFR. AND SUPPLY/USA
MODEL: WAVE 2000
PHOTOS RF PC BOARDS FRONT AND BACK



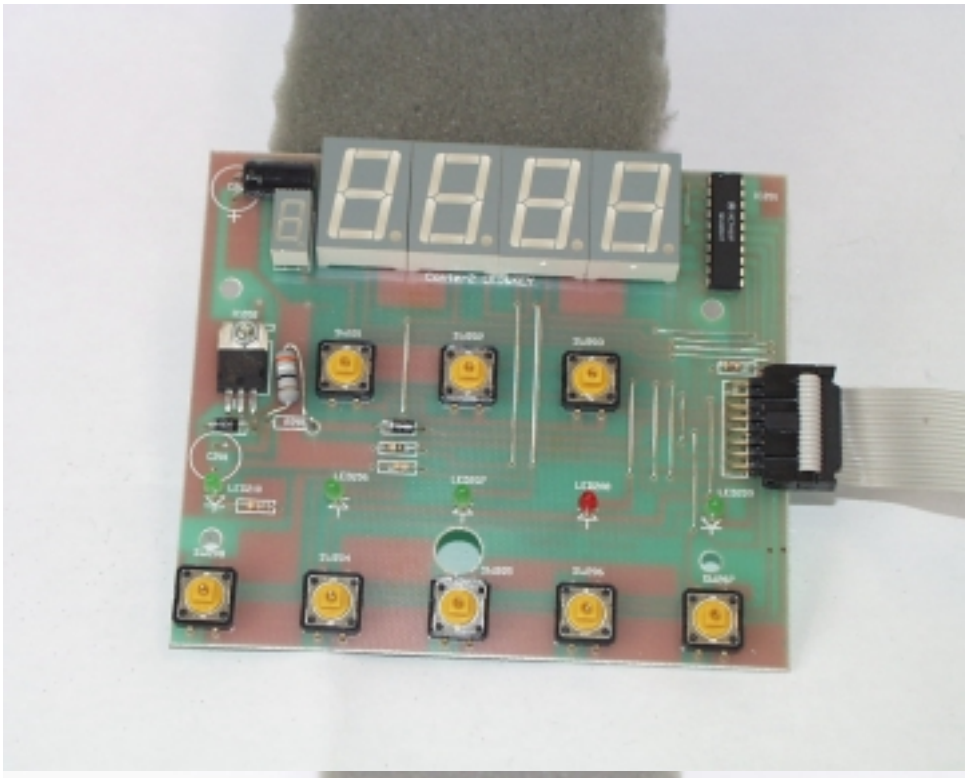


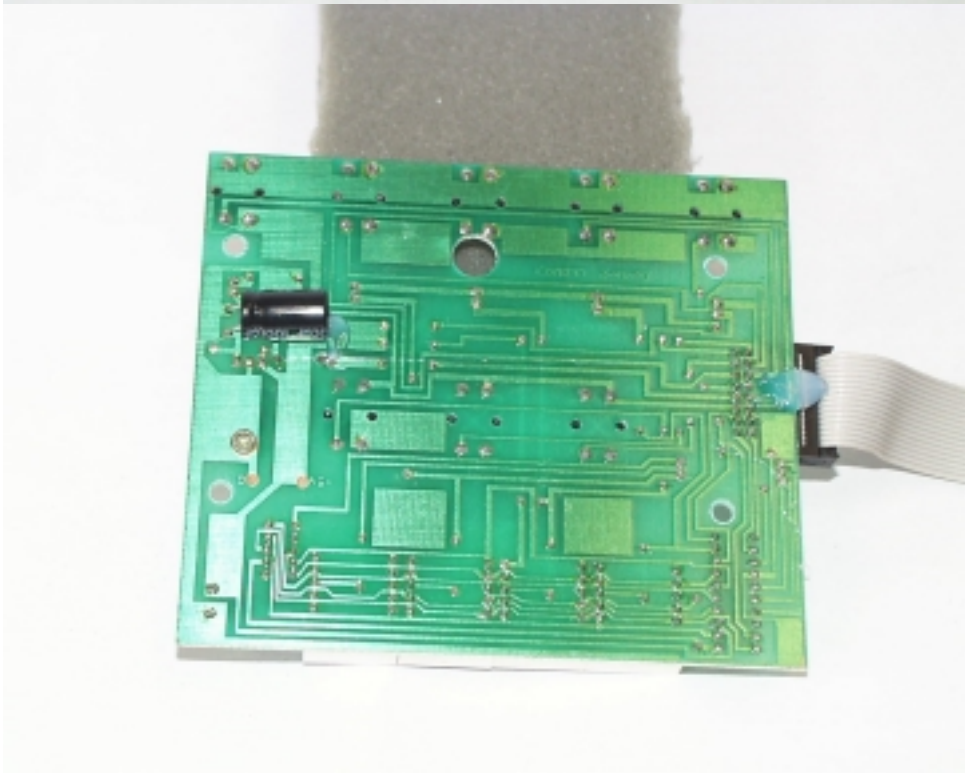
CONTER MFR. AND SUPPLY/USA
MODEL: WAVE 2000
PHOTOS Audio Amp PC BOARD FRONT AND BACK





CONTER MFR. AND SUPPLY/USA
MODEL: WAVE 2000
PHOTOS DISPLAY PC BOARD FRONT AND BACK





CONTER MFR. AND SUPPLY/USA
MODEL: WAVE 2000
PHOTO LABEL LOCATION

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

_____
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

March 12, 1999

Mr. Edmund Chow
CONTER MFR. AND SUPPLY/USA
4200 W. 83rd St., Suite 203
Shawnee Mission, KS 66208

RE: FCC Certification Report for Model: WAVE 2000

Dear Edmund:

Enclosed please find the above report for your Model WAVE 2000. With the modifications to the antenna output chain the unit meets the requirements for certification. These modifications must be incorporated into the production design before marketing the unit. Failure to reduce the output power will cause the unit to perform above the FCC regulated limits.

Please complete the following prior to submitting to the FCC.

1. Add TaxPayer ID# on Form 159 (two locations).
2. Sign Form 159 and Letter of Intent.
3. Attach proper fee for Assignment of Applicant Code payable to FCC in the amount of $45.00 (must be separate check from Certification fee).
4. Send to: FCC
   Equipment Approval Services
   P.O. Box 358315
   Pittsburgh, PA 15251-5315

Keep copies of all the above information with your report at CONTER MFR. AND SUPPLY/USA.

If you have any questions, please do not hesitate to contact me.

Very truly yours,

Scot D. Rogers
ROGERS LABS, INC.

April 15, 1998

Federal Communications Commission
Equipment Approval Services
P.O. Box 35815
Pittsburgh, PA 15251-3315

Applicant: CONTER MFR. AND SUPPLY/USA

Equipment: FCC ID: OG8 PROFMWAVE
FCC Rules: 15.239

Gentlemen:

Please find enclosed Application Form 159 with filing fees attached for Certification of Intentional Radiators operated within the band 88-108 MHz per 15.239. The 731 form and application have been submitted electronically and any attachments will be up loaded to the FCC web site.

Should you require any further information, please contact the undersigned.

Thank you for your consideration in this matter.

Sincerely,

Edmund Chow
CONTER MFR. AND SUPPLY/USA
Enclosures