ACME TESTING, 2002 VALLEY HWY, P.O. BOX 3, ACME, WASHINGTON 98220-0003 888 226-3837.

FCC PART 90 SUBPART I
REPORT OF MEASUREMENTS

DEVICE:	350 MILLIWATT VHF TRANSMITTER
MODEL:	1073
MANUFACTURER:	ROTHENBUHLER ENGINEERING
ADDRESS:	PO BOX 708 2191 RHODES ROAD SEDRO WOOLEY WA 98284

THE DATA CONTAINED IN THIS REPORT WAS
COLLECTED ON 17 FEBRUARY 2000 AND COMPILED BY:

PAUL G. SLAVENS
CHIEF EMC ENGINEER

WORK ORDER #: 2212

1. General

1.1 Purpose

These tests were conducted on a sample of the equipment for the purpose of compliance with FCC CFR 47 Parts 2 & 90.

1.2 Manufacturer

Company Name:	Rothenbuhler Engineering
Contact:	Pete Ruese
Mailing Address:	PO Box 708
Street Address:	2191 Rhodes Road
City/State/Zip:	Sedro Woolley WA 98284
Telephone:	360 856-0836
Fax:	360 856-2183
E-mail:	information@rothenbuhlereng.com

1.3 Test location

Company:	Acme Testing Inc.
Street Address:	2002 Valley Highway
Mailing Address:	PO Box 3
City/State/Zip:	Acme WA 98220-0003
Laboratory:	Test Site 2
Telephone:	888 226-3837
Fax:	360 595-2722
E-mail:	acmetest@acmetesting.com
Web:	www.acmetesting.com
Receipt of EUT:	28 December 1999

1.4 Test Personnel

Paul G. Slavens, Chief EMC Engineer

2. Test Results Summary

Summary of Test Results
Transmitter model 1073

Para. No.	Test Criteria	Status
2.993	Field Strength of Spurious Radiation	Pass

The signed original of this report, supplied to the client, represents the only "official" copy. Retention of any additional copies (electronic or non-electronic media) is at Acme Testing's discretion to meet internal requirements only. The client has made the determination that EUT Condition, Characterization, and Mode of Operation are representative of production units, and meet the requirements of the specifications referenced herein.

Consistent with Industry practice, measurement and test equipment not directly involved in obtaining measurement results but having an impact on measurements (such as cable loss, antenna factors, etc.) is factored into the "Correction Factor" documented in certain test results. Instrumentation employed for testing meets tolerances consistent with known Industry Standards and Regulations.

The measurements contained in this report were made in accordance with the referenced standards and all applicable Public Notices received prior to the date of testing. Acme Testing assumes responsibility only for the accuracy and completeness of this data as it pertains to the sample tested.

Paul G. Slavens
Chief EMC Engineer

Date of Issuance

3. Description of Equipment and Peripherals

3.1 Equipment Under Test (EUT)

Device:	350 milliwatts transmitter
Model Number:	1073
Serial Number:	None
Power:	Internal Battery
Grounding:	Local

3.2 EUT Peripherals

None, the EUT is a stand-alone device.

3.3 Description of Interface Cables

None, the EUT is a stand-alone device.

4. Field Strength of Spurious Radiation

4.1 Test Requirement

Sec. 2.**1053** Measurements required: Field strength of spurious radiation.

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of Sec. 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:
   (1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.
   (2) All equipment operating on frequencies higher than 25 MHz.
   (3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
   (4) Other types of equipment as required, when deemed necessary by the Commission.

4.2 Test Technical Standard

90.210(d3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

4.3 Test Procedure

TIA/EIA-603:1993 Section 2.2.12

4.4 Test equipment

⇒ Spectrum Analyzer: Hewlett-Packard 8566B, Serial Number 2410A-00168, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

⇒ RF Preselector: Hewlett-Packard 85685, Serial Number 2648A-00519, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

⇒ Quasi Peak Adapter: Hewlett-Packard 85650A, Serial Number 2043A-00327, Calibrated: 17 March 1999, Calibration due Date: 17 March 2000

⇒ Line Impedance Stabilization Network: Rhode & Schwarz ESH2-Z5, Serial Number ACMERS1, Calibrated: 1 September 1999, Calibration due Date: 01 September 2000

⇒ Broadband Biconical Antenna (20 MHz to 200 MHz): EMCO 3110, Serial Number 1115, Calibrated: 28 December 1999, Calibration due Date: 28 December 2000

⇒ Broadband Log Periodic Antenna (200 MHz to 1000 MHz): EMCO 3146, Serial Number 2853, Calibrated: 28 December 1999, Calibration due Date: 28 December 2000

⇒ EUT Turntable Position Controller: EMCO 1061-3M, Serial Number 9003-1441, No Calibration Required

⇒ Antenna Mast: EMCO 1051, Serial Number 9002-1457, No Calibration Required

⇒ 2 GHz to 10 GHz Low Noise Preamplifier: Milliwave 593-2898, Serial Number 2494, No Calibration Required

⇒ Double Ridge Guide Horn Antenna: EMCO 3115, Serial Number 9807-5534, Calibrated: 30 December 1999, Calibration due Date: 30 December 2000

4.5 Test Results

Frequency of Emissions (MHz)	Polarization H/V	Received Signal Field Strength dBµV/m @3m	Effective Radiated Power dBm	Limit Radiated Power dBm	Delta to Limit dB
150.955	V	64.3	-33.1	-20.0	-13.1
226.432	V	32.0	-65.4	-20.0	-45.4
301.909	V	34.0	-63.4	-20.0	-43.4
377.411	V	33.9	-63.5	-20.0	-43.5
452.864	V	43.8	-53.6	-20.0	-33.6
528.375	V	45.0	-52.4	-20.0	-32.4
566.117	V	34.0	-63.4	-20.0	-43.4
603.818	V	35.8	-61.6	-20.0	-41.6

CALCULATION OF RADIATED POWER LIMIT

All emissions below 1000 MHz are expressed in terms of the equivalent power that would have to be fed into a dipole antenna in order to produce the same electric field strength. All emissions above 1000 MHz are expressed in terms of equivalent isotropic power. The equivalent power was determined by using the following formula: $P_t = E^2R^2/30\ G$

Example: If the output power of the transmitter is 3 watts.

The minimum attenuation is 50 + l0 Log 3 = 54.8, so the maximum power of any spurious emission must not exceed 4.8 dBW – 54.8 dBW = - 50 dBW = - 20 dBm = 0.01 mW

Using the above relation we have E = $\sqrt{(30 * G * P)}$ /R

For emissions which are less than or equal to 1000 MHz

G =1.64 and E = $\sqrt{}$ (30 x 1.64 x 0.01 x 10^{-3}) / 3 = 7.4 mV/m

= 77.3 dBuV/m

Therefore the electric field strength of emissions must not exceed 77.3 dBuV/m at 3m.

Similarly for emissions which are greater than 1000 MHz, G=1 and the field strength must not exceed 75.2 dBµV/m at 3 m.

CALCULATION OF RADIATED POWER

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Example:	Electric field strength is	E = 41.1 dBuV/m
	Measured at a distance of	R = 3 m
	The gain of a dipole antenna is	1.64

$P_t = [10^{(41.1/20)}\ X\ 10^{-6}]^2 \times 3^2/30 \times 1.64 = 2.36 \times 10^{-9}$ watts = -56.3 dBm

When calculating equivalent isotropic radiated power for emissions above 1000 MHz the gain is G=1.

5. Miscellaneous Comments and Notes

1. None.