

TYPE OF EXHIBIT: RF EXPOSURE EVALUATION

FCC PART: 1.1310

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: DTX-445

TYPE OF UNIT: UHF-FM Transceiver

FCC ID: AIERIT17-445

DATE: 5 June 2009

PROCEDURE:

1. The measurement for effective radiated power was taken at the RITRON, Inc. 3 meter test site. The measurement was via the substitution method.
2. The ERP measurement was made with a Hewlett-Packard Model 8560E Spectrum Analyzer and an Electro-Metrics LPA-25 log periodic antenna.
3. A substitution antenna, an adjustable dipole, was substituted for the DTX-445 on the turntable 3 meters from the pick up antenna. An RF signal generator was set at 460.000 MHz with a 0 dBm output level.
4. The height of the LPA-25 receiving antenna was varied to pick up maximum signal.
5. The DTX-445 was programmed for transmitter operation on 460.000 MHz at the 10 watt maximum obtainable from the unit. The unit was then terminated at the antenna port with a Nearson RAM1545 antenna mounted above a 0.5m x 0.5 m ground plane. Also, a Cushcraft PE-4576 8.2 dBd yagi was tested.
6. The DTX-445 antenna was then positioned on the turntable and the above procedure used to obtain maximum level at the receiving dipole.

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CALCULATIONS:

The effective radiated power can be calculated as:

$$\text{ERP(dBm)} = \text{Pr(dBm)} - \text{Pref(dBm)} + \text{Pgen(dBm)} - \text{Ga(dBd)}$$

Where:

Pr is the power level of the radio's emission at the receiving antenna output.

Pgen is the RF signal generator level at the substitution antenna input.

Pref is the power level of the substitution antenna emission at the receiving antenna output.

Ga is the gain of the substitution antenna relative to a dipole.

For the Cushcraft Yagi we have:

$$\text{ERP(dBm)} = 17.8 - (-28.2) + 0 - 0 = 46 \text{ dBm}$$

$$\text{ERP(watts)} = \text{antilog}((\text{ERP(dBm)} - 30)/10)$$

$$\text{ERP(watts)} = 39.8 \text{ watts}$$

	freq (MHz)	Substitution Power (dBm)	Sub Vert Reading (dBm)	Max Vert (dBm)	Max Pwr ERP (dBm)	Max Pwr ERP (W)
RAM-1545	460	0.0	-28.2	5.2	33.3	2.2

Cushcraft PE-457-6	460	0.0	-28.2	17.8	46.0	39.8
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PROCEDURE:

We will determine the minimum safe operating distance for these occupational device antennae. Converting from ERP to EIRP we multiple by 1.64.

Beginning with the RAM-1545 whip:

$$\text{EIRP(W)} = 2.2 \times 1.64 = 3.61 \text{ W}$$

Power density as related to EIRP is:

$S(\text{W/m}^2) = \text{EIRP}/4\pi r^2$ where r is distance from the source in meters. Rearranging for distance:

$$r = \sqrt{(\text{EIRP}/4\pi S)}$$

The MPE for a device operating in the occupational environment is 1 mW/cm^2 . Converting to W/m^2 we get 10 W/m^2 .

$$r = \sqrt{(3.61/4\pi 10)} = .169 \text{ m}$$

Thus, at a distance of 17 cm or greater the MPE for occupational use is met for the RAM-1545 whip.

For the Cushcraft Yagi we get:

$$r = \sqrt{(39.8/4\pi 10)} = .563 \text{ m} \text{ or } 56 \text{ cm}$$

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WARNING STATEMENT:

The following statement appears in the Users Manual:

RF ENERGY EXPOSURE AWARENESS AND CONTROL INFORMATION, AND
OPERATIONAL INSTRUCTIONS FOR FCC OCCUPATIONAL USE REQUIREMENTS

BEFORE USING YOUR MOBILE 2-WAY RADIO, READ THIS IMPORTANT RF
ENERGY AWARENESS AND CONTROL INFORMATION AND OPERATIONAL
INSTRUCTIONS TO ENSURE COMPLIANCE WITH THE FCC'S RF EXPOSURE GUIDELINES.

NOTICE: This radio is intended for use in occupational/controlled conditions, where users have full knowledge of their exposure and can exercise control over their exposure to meet FCC limits. This radio device is NOT authorized for general population, consumer, or any other use.

This 2-way radio uses electromagnetic energy in the radio frequency (RF) spectrum to provide communications between two or more users over a distance.

It uses radio frequency (RF) energy or radio waves to send and receive calls. RF energy is one form of electromagnetic energy. Other forms include, but are not limited to, electric power, sunlight and x-rays. RF energy, however, should not be confused with these other forms of electromagnetic energy, which when used improperly can cause biological damage. Very high levels of x-rays, for example, can damage tissues and genetic material.

Experts in science, engineering, medicine, health and industry work with organizations to develop standards for exposure to RF energy. These standards provide recommended levels of RF exposure for both workers and the general public. These recommended RF exposure levels include substantial margins of protection. All 2-way radios marketed in North America are designed, manufactured and tested to ensure they meet government established RF exposure levels. In addition, manufacturers also recommend specific operating instructions to users of 2-way radios. These instructions are important because they inform users about RF energy exposure and provide simple procedures on how to control it. Please refer to the following websites for more information on what RF energy exposure is and how to control your exposure to assure compliance with established RF exposure limits.

<http://www.fcc.gov/oet/rfsafety/rf-faqs.html>

<http://www.osha.gov/SLTC/radiofrequencyradiation/index.html>

Federal Communications Commission Regulations

The FCC rules require manufacturers to comply with the FCC RF energy exposure limits for mobile 2-way radios before they can be marketed in the U.S. When 2-way radios are used as a consequence of employment, the FCC requires users to be fully aware of and able to control their exposure to meet occupational requirements. Exposure awareness can be facilitated by the use of a label directing users to specific user awareness information.

Your Ritron 2-way radio has an RF exposure product label. Also, this Ritron DTX-445 user manual includes information and operating instructions required to control your RF exposure and to satisfy compliance requirements.

Compliance with RF Exposure Standards

Your Ritron two-way radio is designed and tested to comply with a number of national and international standards and guidelines (listed below) regarding human exposure to radio frequency electromagnetic energy. This radio complies with the IEEE and ICNIRP exposure limits for occupational/controlled RF exposure environment at duty factors of up to 50% talk and 50% listen and is authorized by the FCC for occupational use. In terms of measuring RF energy for compliance with the FCC exposure guidelines, your radio antenna radiates measurable RF energy only while it is transmitting (during talking), not when it is receiving (listening) or in standby mode. Your Ritron two-way radio complies with the following RF energy exposure standards and guidelines:

- United States Federal Communications Commission, Code of Federal Regulations; 47 CFR §§ 2 sub-part J.
- American National Standards Institute (ANSI) / Institute of Electrical and Electronic Engineers (IEEE) C95. 1-1992.
- Institute of Electrical and Electronic Engineers (IEEE) C95.1-1999 Edition.
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To control exposure to yourself and others and ensure compliance with the occupational/controlled environment exposure limits always adhere to the following procedures:

Guidelines:

- User awareness instructions should accompany device when transferred to other users.
- Do not use this device if the operational requirements described herein are not met.

Instructions:

- Transmit only when people in the vicinity are at least the recommended minimum lateral distance away, as shown in Table 1, from a properly installed antenna according to installation instructions.

NOTE - Table 1 lists the recommended minimum lateral distance for bystanders in a controlled environment from transmitting unity gain vertical whip and 6 dB gain Yagi antennas.

Table 1. Rated Power and Recommended Lateral Distance

Antenna Model	Rated Power of Mobile Two-way Radio	Recommended Minimum Lateral Distance from Transmitting Antenna
Ram1545 (vertical whip)	10 watts or less	6.7 inches (17 cm)
Cushcraft PE-457-6 (6dB Yagi)	10 watts or less	22 inches (56 cm)

Antennas

- Install vertical omni directional antennas above a suitable ground plane taking into account the recommended minimum lateral distances in table 1. The antenna installation should additionally be in accordance with:

- a.) The requirements of the antenna manufacturer/supplier.
- b.) Instructions in the Radio Installation Manual, including minimum antenna cable lengths.
- c.) The installation manual should provide specific information of how to install the antennas to facilitate recommended operating distances to all potentially exposed persons.

Contact Information

For additional information on exposure requirements or other information, contact Ritron at (317) 846-1201 or www.ritron.com.