TYPE OF EXHIBIT: RF EXPOSURE EVALUATION

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

MODEL: DTX-254

TYPE OF UNIT: 220 MHz Transceiver Module

FCC ID: AIERIT20-254

DATE: December 23, 2004

PROCEDURE:

Because this product can be used as a mobile device, an RF evaluation was done. The RF evaluation entailed testing the unit on RITRON'S 3-meter range to determine EIRP and then calculating the minimum safe distance from the antenna necessary to ensure compliance with the appropriate RF exposure limits.

1. The measurement for effective radiated power was taken at the RITRON, Inc. 3-meter test site, details of which are on file with Industry Canada.

2. The DUT was aligned for transmitter operation on 230.025 MHz at the 6.0 watt maximum output power rating of the DTX-254 per the tune-up procedure outlined in the Maintenance Manual. The unit was then terminated at the antenna port in a quarterwave magnetic mount antenna which is typical of what might be used with this product. (The user may connect other antennas, however.)

3. All field strength measurements were made with the Hewlett-Packard Model 8560E Spectrum Analyzer and an Electro-Metrics EM-6924 adjustable dipole antenna tuned to 230 MHz.

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PROCEDURE (CONT.):

4. The quarterwave antenna was connected to the DUT via its cable and tested above a 0.5m x 0.5 m ground plane. The height of the field strength measurement antenna and the azimuth orientation of the antenna were varied to provide maximum field strength. The maximum levels were noted.

5. A substitution antenna, an Electro-Metrics EM-6924 adjustable dipole, was substituted for the quarterwave antenna at the DTX-254's previous location. An RF signal generator was set for the frequency of the DUT with the level at the substitution antenna noted.

6. The height of the receiving antenna was adjusted for maximum signal strength. The level at the receiving antenna was noted.

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EQUATIONS FOR EIRP:

The substitution antenna is specified from the manufacturer in terms of antenna factor rather than antenna gain. The conversion is:

Ga(dbd) = 20 log f (MHz) – AF(dB) – 31.9

The effective radiated power (ERP) is then:

ERP(dBm) = Pr(dBm) + Pgen(dBm) – Ps(dBm) – 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.

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

Ga is the gain of the substitution antenna.

The ERP is converted to watts from dBm by:

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

And finally, ERP is converted to EIRP (isotropic radiator) by:

EIRP = 1.64 ERP

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RESULTS FOR EIRP:

Antenna	Pr (dBm)	Pgen (dBm)	Ps (dBm)	Ga (dBd)	ERP (dBm)	EIRP (watts)
Quarterwave	+11.5	-0.3	-27.3	0.1	+38.4	11.3

DETERMINING MPE DISTANCE:

Power density is related to EIRP:

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

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

The MPE (maximum permissible exposure) for a device operating in a General Population/Uncontrolled environment is 0.2 mW/cm^2 . Converting to W/m^2, the limit becomes 2.0 W/m^2. The MPE limit of 2.0 W/m^2 is substituted for S and EIRP is entered in the above equation.

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RESULTS FOR MPE:

Antenna	EIRP (watts)	S limit W/m^2	Distance cm	Distance in
Quarterwave	11.3	2.0	67	26

RF WARNING STATEMENT:

The following statement appears in the User/Maintenance Manual regarding RF safety:

The DTX-254 has been evaluated for compliance with the maximum exposure limits for RF energy at the maximum power rating of the unit with a common unity gain quarterwave magnetic mount mobile antenna. To ensure compliance with the General Population/Uncontrolled maximum exposure limits, please observe the following:

When the quarterwave remote magnetic mount antenna is used, mount the antenna in a location that will ensure that all persons will be at least 26 inches (67 cm) away from the antenna.

Antennas other than a quarterwave magnetic mount antenna must be tested with the DTX-254 for RF exposure compliance in the environment in which it is to be used per the FCC's OET Bulletin 65, Edition 97-01 or Industry Canada RSS-102.