

TYPE OF EXHIBIT: TRANSMITTER EFFECTIVE RADIATED POWER

FCC PART:

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

MODEL: RLR-460

TYPE OF UNIT: UHF FM Repeater

FCC ID: AIERIT15-460

DATE: November 19, 2002

PROCEDURE:

1. The measurement for effective radiated power was taken at the RITRON, Inc. 3 meter test site, details of which are on file with the FCC.
2. The RLR-460 was aligned for transmitter operation on 457.1125 MHz at the 5.0 watt maximum output power rating for the unit per the tune-up procedure outlined in the Maintenance Manual. The unit was then terminated at the antenna port with the two antennas available from RITRON for use with this product, the AFB-1545 articulated whip and the RAM-1545 magnetic mount antenna. (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.
4. With the AFB-1545 whip antenna, the RLR-460 was mounted in the three orientations possible, horizontal, vertical with long dimension horizontal, and vertical with long dimension vertical. The height of the field strength measurement antenna and the azimuth orientation of the RLR-460 were varied to provide maximum field strength. The AFB-1545 antenna was replaced with the RAM-1545 antenna connected via its cable and tested above a 0.5m x 0.5m 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 RLR-460 at the RLR-460's location and at the location of the RAM-1545 antenna when it was used. An RF signal generator was set for the frequency of the RLR-460 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 field strength antenna was noted.

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EQUATIONS:

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

$$Ga(dBd) = 20 \log f (\text{MHz}) - AF(\text{dB}) - 31.9$$

The effective radiated power (ERP) is then:

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

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:

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

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RESULTS:

Antenna	Pr (dBm)	Pgen (dBm)	Ps (dBm)	Ga (dBd)	ERP (dBm)	ERP (watts)
AFB-1545	+8.5	0.0	-28.4	0.3	+36.6	4.57
RAM-1545	+2.8	0.0	-28.4	0.3	+30.9	1.23

TYPE OF EXHIBIT: MAXIMUM PERMISSIBLE EXPOSURE EVALUATION

FCC PART:

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505 West Carmel Drive
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DATE: February 5, 2003

EQUATIONS AND MPE DISTANCE CALCULATIONS:

The ERP values previously calculated will be used to determine the minimum safe distance from the antenna supplied by RITRON in order not to exceed the Occupational Limits of RF exposure.

The ERP must be converted to EIRP to simulate an isotropic radiator. Since a resonant halfwave dipole has a gain of 1.64 referenced to an isotropic radiator:

$$\text{EIRP} = 1.64 \text{ ERP.}$$

Power density is related to EIRP:

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

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

The MPE limit for a device operating in a General Population/Uncontrolled environment is $f(\text{MHz})/1500 \text{ mW/cm}^2$ which for this product at the upper band edge is 0.31 mW/cm^2 .

For the equation above, mW/cm^2 must be converted to W/m^2 . Since $1 \text{ mW/cm}^2 = 10 \text{ W/m}^2$, the FCC limit is 3.1 W/m^2 .

The MPE limit of 3.1 W/m^2 is substituted for S and the EIRP is entered in the above equation. The results for the two antennas become:

Antenna	ERP	EIRP	Distance (cm)	Distance (in)
AFB-1545	4.57	7.49	44	17
RAM-1545	1.23	2.02	23	9

TYPE OF EXHIBIT: RF WARNING STATEMENT

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STATEMENT:

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

This product has been evaluated for compliance with the maximum permissible exposure limits for RF energy at the maximum power rating of the unit and with the two antennas sold for use with this product by RITRON. To ensure compliance with the General Population/Uncontrolled maximum exposure limits, please observe the following:

When the AFB-1545 articulated joint dual-band antenna is mounted to the rear of the unit, mount the RLR-460 in such a way, and in a location, that will ensure that all persons will be at least 17 inches (44 cm) away from the antenna.

When the RAM-1545 remote magnetic mount antenna is used, mount the antenna in a location that will ensure that all persons will be at least 9 inches (23 cm) away from the antenna.