FCC Form 312
Exhibit B
RF Hazard Assessment of the AT2220 Terminal

1. Introduction

This report analyzes the non-ionizing radiation levels for the AT2220 earth station. The AT2220 is typically mounted on a helicopter or light aircraft. The device is designed in such a way that separation distance of much greater than 47 cm is normally maintained between the transmitter's radiating structure and the body of nearby persons.

2. Governing Limits

The AT2220 operates within the frequency range of 300 kHz and 6 GHz, evaluation of human exposure to RF radiation can be used as set forth in FCC's Section 47 CFR § 1.1307(b).

Table 1 of FCC's Section 47 CFR § 1.1310 specifies that there are two separate tiers of exposure limits that are dependent upon the situation in which the exposure takes place and/or the status of the individuals who are subject to the exposure. The two tiers are General Population / Uncontrolled environment, and an Occupational / Controlled environment.

The applicable maximum exposure (MPE) limit for this antenna is the General Population / Uncontrolled environment i.e., areas that people may enter freely, at this frequency of operation is 1 mW/cm2 average power density over a 30 minute period (Reference 1).

The formulae provided in FCC OET Bulletin 65 (Reference 2) are utilized to calculate near- and far-field ranges and power spectral densities.

3. Summary Results

As described in Exhibit A, the typical installation will be mounted on the top of a helicopter or light aircraft. During operation, the user will be greater than 47 cm away from the unit. The maximum gain (used in this analysis) occurs at a 90 degree elevation angle and is reduced significantly at an elevation angle of 15 degrees. At the edge of the far field region, a PFD of 32.7 mW/cm^2 is obtained, decaying rapidly to 1 mW/cm^2 at a distance of 47 cm from the antenna axis. Power decays dramatically from that point towards personnel at entry doors or inside the aircraft near the windows, remaining below hazardous PSD levels.

Based on the above analysis it is concluded that no hazard exists for the public.

4. Radiation Hazard Assessment

4.1 Definition of Terms

The terms are used in the formulas here are defined as follows:
S = power density at the specified distance

Rff = distance to the beginning of the far-field

R = 0.47 m (18.6 in)	distance to point of interest
P = 6.3 W	power fed to the antenna in Watts
D = 0.166 m	effective diameter of antenna array
G = 4.5	power gain relative to an isotropic radiator
F = 1675	frequency in MHz
λ = 0.181 m	wavelength in meters (300/FMHz)

4.2 Governing Parameters

The antenna parameters of Table 1 are used to calculate the power flux densities ("PFDs") for this terminal installation. Items 1 through 5 reflect the system design point. As indicated in Item 6, the system can provide 14 dBW. The assessment is conservative as the radome loss is excluded from the analysis. The antenna half-power beamwidth is approximately at +/-60°.

Table 1. System Parameters

Item	Parameter	Value
1	Frequency	1625 – 1660.5 MHz
2	Antenna maximum length, D	0.166 meter
3	Wavelength, λ, at 1675 MHz	0.181 meter
4	Boresight gain, G(dB)	6.5 dBic
5	Max power into antenna	8 dBW
6	Max EIRP at 1675 MHz	14 dBW
7	Reactive Near field	0.038 m

4.2.1 Near-Field Region

The extent of the near-field region is described by Equation 1 (D and λ in same units), where "R_{nf}" signifies "range to the farthest edge of the near field":

$$R_{nf} = D^2 / (4\lambda) = (0.166\text{ m})^2 / (4 * 0.181\text{m}) = 0.038\text{ m} \quad \textbf{(1)}$$

Since user separation distance is much larger than farthest edge of the near field, far-field model is used to provide a conservative estimate.

4.2.2 Distance to far-field

From Reference 1, the distance to the beginning of the far field region is:

Range to far-field region, $R_{ff} = 0.6*D^2 / \lambda = 0.091$ meters **(2)**

4.2.3 Maximum Power Flux Density at evaluation distance of 9.1 cm

From Table 1, the maximum on-axis PFD at the nearest edge of the far field region is calculated, as follows:

PFD, far-field = $P * G / (4 * \pi * R^2)$
$= (6.3 \text{ W} * 4.5) / (4 * \pi * (0.083 \text{ m})^2)$
$= 32.7 \text{ mW/(cm)}^2$ **(3)**

The power density at the point of interest in the far-field region of the radiation pattern can be estimated by the equation:

Sff $= (P * G) / (4 * \pi * R^2)$

$= (6.3 \text{ W} * 4.5) / (4 * \pi * (0.47 \text{ m})^2) = 0.99 \text{ mW/cm}^2$ **(4)**

Calculations are based on maximum power and assumes that device may operate continuously, and thus are very conservative. At separation distance of 46 cm, power density drops below 1 mW/(cm)^2 , MPE limit for general population/uncontrolled exposure.

The proposed earth station system will be mounted on the top of a helicopter or light aircraft. The maximum gain (used in this analysis) occurs at a 90 degree elevation angle and is reduced significantly at an elevation angle of 15 degrees.

Therefore, it is concluded that the device generates no RF hazards in the far field region for the public.

5.0 Owner/Operator Responsibility

It is the responsibility of the owner and operator of the terminal to adhere to the warnings provided by the manufacturer, whether provided on the labels on the unit or in the supplied manuals. This includes keeping any labels of the mounting platform in good condition and within clear view of anyone within close proximity (within 47 cm).