Radiation Hazard Analysis

Get SAT Communications LTD
Nano H Ka
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1. Introduction

This analysis assesses the non-ionizing radiation levels for the Get SAT Nano H Ka ("Nano H Ka") terminal. The calculations performed in this analysis are consistent with the recommendations articulated in the Commission's Office of Engineering and Technology Bulletin, Number 65 ("Bulletin 65"). This analysis demonstrates that the Nano H Ka complies with the applicable radiation exposure limits.

Bulletin 65 and Section 1.310 of the Commission's rules specify two separate exposure limits: one for Occupational/Controlled Exposures and one for General Population/Uncontrolled Exposures. The maximum level of non-ionizing radiation to which employees may be exposed under the occupational threshold is limited to a power density level of 5 milliwatts per square centimeter (5 mW/cm2) averaged over any 6-minute period in a controlled environment. The maximum level of non-ionizing radiation to which the General Population may be exposed is limited to a power density level of 1 milliwatt per square centimeter (1 mW/cm2) averaged over any 30-minute period in an uncontrolled environment.

This report analyzes the maximum power density levels in the vicinity of an ES terminal antenna in five regions: (1) the far field, (2) the near field, (3) the transition region between near field and far field, (4) near the main reflector surface, and (5) between the main reflector and the feed. These radiation regions were analyzed using the definitions and formulas in Bulletin 65 for aperture antennas. The results of this analysis are summarized below and identify the potential exposure under nominal operating conditions and worst-case conditions, respectively.

2. Input Parameters

The input parameters below are those used to determine the radiation levels for the proposed Nano H Ka terminal.

Nano H Ka Earth Station Parameter Chart

Antenna Diameter	$D_{maj} := 0.14$
Antenna Surface Area	$A_{\mathrm{ref}} := 0.015$
Antenna Feed Mouth Area	$A_{\mathrm{feed}} := 0.001$
Antenna Isotropic Gain	$G := 30.5$
Nominal Antenna Efficiency	$\eta := 60\%$

Nominal Frequency	f := 30 Ghz
Nominal Wavelength	$\lambda := 0.01$
Maximum Transmit Power / Carrier	$P_{car} :=$ 8 watt
Number of Carriers	$N_{car} := 1$
Total Transmit Power	$P_{total} :=$ 8 watt
W/G Loss from Transmitter to Feed	
Total Feed Input Power	$P_{feed} :=$ 6.5 watt

3. Analysis

At the Antenna Surface. The maximum power density directly in front of an antenna (e.g., at the antenna surface).

$$S_{ref} := \frac{4P_{total}}{A_{ref}}$$

Power Density	249.578	mW/cm^2

Near Field Region. The near field region is an elliptical volume co-incident with the boresight of the main beam extending outward from the main reflector.

Near Field Region	$R_{nf} := \frac{D_{maj}^2}{4\lambda}$	0.5 m = 50 cm
Power Density	$s_n = \frac{16P}{\pi\eta D^2}$	249.578 mW/cm^2

Transition Region. The transition region is located between the near field region and the far field region. This region has a power density that decreases inversely with increasing distance. Therefore, the power density in the transition region will be less than the power density in the near field for the purpose of evaluating potential exposure.

Transition Region	R_{nf} to R_{ff}	0.5 m to 5 m

Far Field Region. That region of the field of an antenna where the angular field distribution is essentially independent of the distance from the antenna.

Far Field Region	$R_{ff} := 0.6 \frac{D_{maj}^2}{\lambda}$	0.5 m = 50 cm
Power Density	$S_{ff} := \frac{P_{total} G}{4 \pi R_{ff}^2}$	2.9 mW/cm^2

Region between the Main Reflector and the Feed.

The region where radiation is emitted is where power is fed to the antenna from a transmitter feed mounted on a mast at the focal point of the antenna. Radiation from this source is then incident on to the main reflector resulting in the transmission of a collimated beam.

Conclusion and Site Access Restrictions

The analysis above demonstrates that the Nano H Ka will only exceed the general population radiation limits at the antenna's surface and in the near-field region. Otherwise, the Nano H Ka will not pose a risk of harmful radiation hazard to either the occupational or general population. To prevent access to the antenna's surface, SES Space and Defense, Inc. and Get SAT Communications LTD will ensure that the sites are sufficiently restricted to limit the potential for any exposure to the general population and secure the terminal behind proper signage.

This will ensure the general population does not have access to the antenna surface region of the Nano H Ka.