Exhibit D

Radiation Hazard Analysis

Introduction

This analysis calculates the non-ionizing radiation levels for a ViaSat, Inc. ("ViaSat") M32 aeronautical mobile earth station terminal ("AES terminal"). The calculations performed in this analysis comply with the methods described in FCC Office of Engineering and Technology Bulletin, Number 65 (Edition 97-01) ("Bulletin 65"). This analysis demonstrates that ViaSat AES terminals are compliant and will not result in exposure levels exceeding the applicable radiation hazard limits.

Bulletin 65 and Section 1.1310 of the Commission's rules specify two separate tiers of exposure limits: one for Occupational/Controlled Exposures and one for General Population/Uncontrolled Exposures. Limits for Occupational/Controlled Exposures apply in situations when persons are exposed as a consequence of their employment and are fully aware of and can control their exposure. These limits also apply in situations when a person is transient through a location where such limits would otherwise apply provided the person is made aware of the potential for exposure. The limits for General Population/Uncontrolled Exposure apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure. ViaSat will typically deploy its AES terminals on commercial airliners where access to the area around the aircraft is a Controlled Environment, but not all personnel may be aware of the exposure risk. Accordingly, this analysis discusses the Maximum Permissible Exposure ("MPE") limit for both of these types of exposures. The MPE limit for Occupational/Controlled Environments is a power density equal to 5 milliwatts per centimeter squared averaged over a six minute period. The MPE for General Population/Uncontrolled Environments is a power density equal to 1 milliwatt per centimeter squared averaged over a thirty minute period.

As described in the definitional section of Appendix A, this report analyzes the maximum power density levels in the vicinity of an AES terminal antenna in four regions: (1) the far field, (2) the near field, (3) the transition region between near field and far field, and (4) near the main radiator surface. These radiation regions were analyzed using the definitions and formulas in Bulletin 65 for aperture antennas. The results of this analysis are summarized in Table 1.

AES Terminal Description

The AES terminal uses the same Exede modem technology as the blanket license terminals currently authorized under license call signs E100143 and E120075. It transmits bursts of information at designated times that are assigned to the terminal by the network. The length and carrier frequency of each transmission burst depend on the AES terminal's mode of operation. There are three modes of operation: (a) Idle Mode, during which the AES terminal is not in active use; (b) Normal Mode, when there terminal is actively used under typical network loading conditions; and (c) High Capacity Mode, when the terminal is actively used under maximum uplink data transfer conditions.

In Idle Mode, the AES terminal transmits only timing and system information to the network for 0.4 millisecond every 640 ms seconds. The average duty cycle (ratio of transmitter on to transmitter off time) in Idle Mode is 0.06%. In Normal Mode, the AES terminal transmits burst traffic to the network with a nominal duty cycle of 10%. To support heavy data upload requirements such as file transfer, current network configuration allows AES terminals to increase their transmit duty cycle to 30% in High Capacity Mode. In practice, operation at 100% duty cycle will not happen due to network configuration and operational loading of the shared return channel.

Table 1 provides a summary of the radiation exposure analysis for each of the three ViaSat operating modes.

The AES terminal uses a transmitter power control system to reduce uplink interference and mitigate the effects of changing atmospheric conditions. At maximum power output, the ViaSat M32 AES terminals will transmit at a power level of 4.4 watts or less.

The AES terminal incorporates two "fail safe" features that limit the potential for human exposure. First, the transmitter is not enabled until the receive down link connection to the satellite has been established and an acceptable down link bit error rate has been achieved. The transmitter is disabled very quickly, in less than 40 milliseconds, if a loss of down connectivity occurs. Transmissions will not resume until approximately 10 seconds after downlink communications have been reestablished. Second, the terminal's transmitter is not capable of operating in a continuous transmit mode of operation. The AES terminal's outdoor unit incorporates a watchdog timer that will shut down the transmitter if it remains in a continuous transmit state for more than 10 seconds. Under these conditions, the transmitter will be turned off for 3 ms then resume normal operation after an internal reset has occurred.

Explanation of the Analysis

The "Calculated Values" in Table 1 are the on-axis exposure rates calculated using the formulae from the Office of Engineering and Technology Bulletin Number 65 (Edition 97-01) for a system with continuous (100% transmit duty cycle) transmission. The ViaSat network, however, is based on so-called "shared pipes." ViaSat terminals transmit short bursts of data periodically as instructed by the network and do not operate using continuous transmission. Therefore, in order to compute the effective radiated energy of a ViaSat AES terminal, the terminal's transmitter duty cycle has been used to adjust the values calculated from Bulletin Number 65.

The columns in the tables labeled "Idle Mode," "Normal Mode," and "High Capacity Mode" reflect the total potential for human exposure based on the length of time that the AES terminal transmits energy during a rolling 30 minute period. In Idle Mode, the maximum transmitter duty cycle is 0.06% and therefore the values in the column labeled "Idle Mode" are equal to the calculated values multiplied by 0.0006. Similarly, in Normal Mode the maximum transmitter duty cycle is 10% and the values in the column labeled "Normal Mode" are equal to the Calculated Values multiplied by 0.1. And finally, in High Capacity Mode the transmitter duty cycle is 30% and the values in the column labeled "High Capacity Mode" are equal to the Calculated Values multiplied by 0.3.

The MPE level calculations for each of the three operating modes for conditions labeled "Aperture" are calculated based on the "fail safe" features of the ViaSat AES terminal. When the receive signal is lost due to signal blockage, the transmitter is shut down until the receive downlink is restored. The transmitter is shutdown in less than 40 milliseconds of the loss of the downlink. Since the areas of high field strength near the reflector and the feed are very sensitive to blockage of the down link, this "fail safe" feature minimizes the potential for human exposure. If the blockage due to human exposure occurs in these areas, the downlink will be interrupted causing the transmitter to turn off almost immediately, and it will remain off until the blockage is removed. After the blockage is removed, the AES terminal will have to reacquire the receive downlink and wait to be invited back into the network before the transmitter will be enabled. The complete downlink recovery time is 10 seconds. The values in the column labeled “Idle,” “Normal,” and “Worst Case” are multiplied by 0.004 because the transmitter cannot transmit more than 0.4% of any rolling 30 minute period with significant blockage near the sub-reflector and between the sub-reflector and the feed.

Results of Analysis

This analysis demonstrates that the ViaSat M32 AES terminal satisfies the requirements and guidelines in Section 1.1310 of the FCC’s rules. The terminal does not exceed the MPE limit of 1 milliwatt per centimeter squared averaged over a thirty minute period in the far field and transition regions, as well as in the near-field under typical operating conditions. As demonstrated in Table 1, the area with the greatest field concentrations is the Near Field. The area in which these high field concentrations exist is very small in size, located on the top of the aircraft fuselage, and pointing upward. Proximity to the antenna will also be limited by the radome. Therefore, it is highly unlikely that the general population will have access to the Near Field. However, if the down link (receive signal) is interrupted by an object in an area of high field concentration, the uplink (transmit signal) is shut down in less than 40 milliseconds and the receiver down link recovery time is 10 seconds. The uplink will remain off until the blockage is removed and the downlink recovery is complete. This feature, coupled with the terminal’s use of uplink power control and non-continuous operation, ensures that the general population will not be exposed to levels of radiation that exceed FCC limits. Furthermore, the MPE limit for occupational environments is met in all regions. Moreover, in the remote event that maintenance personnel are located above the aircraft and directly in front of the aperture, they will be protected by the fail-safe features described above.

Conclusion

This radiation hazard analysis demonstrates that ViaSat AES terminals will not result in exposure levels exceeding the applicable radiation hazard limits for either the Occupational/Controlled Environment or General Population/Uncontrolled Environments.

Definitions

1) Far Field Region

The far field region extends outward from the antenna, beginning at a distance of $\frac{0.6 \cdot D_{maj}^{2}}{\lambda}$ meters where the larger diameter of the array antenna is D_{maj}. The maximum power density is calculated using the equation recommended in Bulletin 65.

2) Near Field Region

The near field region is a volume co-incident with the boresight of the main beam extending outward from the radiator surface. The length of the near field $\frac{D_{maj}^{2}}{4 \cdot \lambda}$ meters. The larger dimension (D_{maj}) of the array is used in place of the diameter of a circular antenna to calculate the worst case length of the near field.

3) 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.

4) Region Near the Array Surface

The power density near the array's radiating surface can be estimated as equal to four times the power divided by the area of the radiator surface, assuming that the illumination is uniform and that it would be possible to intercept equal amounts of energy radiating towards and reflected from the antenna surface.

Table 1: Radiation from Mantarray M32 Antenna

Input Parameters

Antenna Aperture Major Axis:	$D_{maj} := 24.8 \cdot in$	$D_{maj} = 62.992 \cdot cm$
Antenna Aperture Minor Axis:	$D_{min} := 6.2 \cdot in$	$D_{min} = 15.748 \cdot cm$
Frequency of Operation:	$F := 30 \cdot GHz$	
Max Power into Antenna:	$P := 4.4 \cdot W$	
Aperture Efficiency:	$\eta := .73$	

Calculated Values

Wavelength:	$\lambda := \frac{c}{F}$	$\lambda = 0.01 \cdot m$	
Area of Reflector:	$A_{apr} := D_{maj} \cdot D_{min}$	$A_{apr} = 0.099\, m^2$	$A_{apr} = 153.76 \cdot in^2$
Effective Aperture Diameter:	$D_{apr} := \sqrt{\frac{(4 \cdot A_{apr})}{4}}$	$D_{apr} = 31.496 \cdot cm$	
Antenna Gain:	$G := \frac{\eta \cdot 4 \cdot \pi \cdot A_{apr}}{\lambda^2}$	$G = 9.113 \times 10^3$	$10 \cdot log(G) = 39.596$ dBi
Length of Near Field:	$R_{nf} := \frac{D_{maj}^2}{4 \cdot \lambda}$	$R_{nf} = 9.927\, m$	
Beginning of Far Field:	$R_{ff} := 0.6 \cdot \frac{D_{maj}^2}{\lambda}$	$R_{ff} = 23.824\, m$	

Power Density Calculations

Far Field:	100% Duty Cycle	Idle Mode	Normal Mode	High Capacity Mode
$S_{ff} := \frac{P \cdot G}{4 \cdot \pi \cdot R_{ff}^2}$	$S_{ff} = 0.562 \cdot \frac{mW}{cm^2}$	$S_{ff} \cdot 06\% = 0.034 \cdot \frac{mW}{cm^2}$	$S_{ff} \cdot 10\% = 0.056 \cdot \frac{mW}{cm^2}$	$S_{ff} \cdot 30\% = 0.169 \cdot \frac{mW}{cm^2}$

Near Field:	100% Duty Cycle	Idle Mode	Normal Mode	High Capacity Mode
$S_{nf} := \frac{16 \cdot \eta \cdot P}{\pi \cdot D_{maj}^2}$	$S_{nf} = 4.123 \cdot \frac{mW}{cm^2}$	$S_{nf} \cdot 06\% = 0.247 \cdot \frac{mW}{cm^2}$	$S_{nf} \cdot 10\% = 0.412 \cdot \frac{mW}{cm^2}$	$S_{nf} \cdot 30\% = 1.237 \cdot \frac{mW}{cm^2}$

Transition Region: Power density is less than the maximum near field region power density and greater than the minimum far field region power density.

Aperture:	Idle Mode	Normal Mode	High Capacity Mode
$S_{apr} := \frac{4 \cdot P}{A_{apr}} \cdot \frac{1}{10^{\left(\frac{L_{Rad}}{10}\right)}} \cdot 0.4\%$	$S_{apr} \cdot 0.6\% = 0 \cdot \frac{mW}{cm^2}$	$S_{apr} \cdot 10\% = 0.005 \cdot \frac{mW}{cm^2}$	$S_{apr} \cdot 30\% = 0.016 \cdot \frac{mW}{cm^2}$