FCC RF COMPLIANCE ASSESMENT

Prepared for

STRATOS OFFSHORE SERVICES COMPANY

3.8 METER VSAT HUB OPERATION

The following is an assessment of compliance with applicable FCC limits for maximum permissible exposure (MPE) for the 3.8 meter Hub antenna for a VSAT network operated by Stratos Offshore Services Company.

As will be explained, the results of the assessment apply to Ku-band Hub operations whose antenna diameters are no smaller than 3.8 meters and whose antenna input power is up to 43.6 watts. In all cases, the access to the antennas is limited to Stratos' personnel who apply standard RF safety procedures. The MPE limit that applies is the one for "controlled" (occupational) exposure.

Based on the results of the mathematical analysis of potential RF exposure levels. the limited access to the areas of interest, and the application of standard RF safety procedures, it is our expert conclusion that Stratos' VSAT operations are in compliance with the FCC regulations and applicable MPE limits.

The sections that follow provide all the necessary background underlying the analysis and our conclusion regarding compliance.

Operational Data

The relevant data for the subject operation is summarized as follows:

Transmitting Frequency Bands:	14.0 – 14.5 GHz
Antenna Type:	Aperture
Antenna Dimension (Diameter):	3.8 meters
Maximum Power input t Antenna (@flange)	43.6 watts

Applicable MPE Limit

For frequencies above 1.5 GHz, the applicable FCC MPE limit for acceptable, continuous exposure of the general population is 1.0 milliwatt per square centimeter (mW/cm2), and for "controlled" occupational exposure, the limit is 5.0 mW/cm2.

Ku-Band operations fall in this range, the MPE limits for Ku- band. Immediate access to Stratos' Hub site is restricted to trained Stratos personnel, and thus the latter limit applies.

FCC Models and Calculations

FCC Bulletin OET 65 provides standardized formulas for calculating the power density in both of the areas of possible interest here: (1) directly in front of the antenna, at the face and farther away but still in the main beam; and (2) to the side of the antenna. Each area of interest will be addresses in the subsections below.

Note that in each of the models, the parameters of interest focus on determining the power density at various locations around the antenna. Specifically, the antenna parameters of interest are the power input and the antenna diameter. Recalling then,

that the same MPE limit applies to Ku-band VSAT operations, The antenna diameter is at some minimum value and the power input is set at some maximum value.

In this case, all Stratos VSAT operations of interest use an antenna diameter of 3.8 meters, and the maximum antenna input power 43.6 watts. Therefore, a single compliance assessment can be applied.

Potential Exposure Levels Directly in Front of the Antenna

Before proceeding to these calculations, it is relevant to note that potential exposure in the areas in front of the antenna – whether at the surface of the antenna or in the extended main beam – is obviated by standard practices involving RF safety and RF design, immediate access to the antenna is restricted and limited to Stratos' trained personnel; the earth station transmitter will be turned off whenever maintenance and repair personnel are required to work on the antenna. That basically prevents any exposure issue right at the face of the antenna. Potential exposure in the extended beam of the antenna is obviated by sound engineering practice; the beam of each VSAT requires a clear, unobstructed view of the satellite(s) with which it communicates. Proper engineering and positioning of the antenna prevents the beam from being obstructed by any nearby object, including human beings. Thus the "potential" exposure in these areas is never "actual". However, the results of these calculations do serve as confirmation of the need for safety procedures, and also serve as a reference point for calculations for RF levels to the side of the antennas.

According to the Bulleting OET 65, the applicable formula for power density (S) at the antenna surface is as follows:

$$S = 4*P/A$$

where P represents the antenna input power and A is the surface area of the antenna.

In this case, with 43.6 watts maximum input power and an antenna diameter of 3.8 meters, the power density at the antenna surface is 1.5377 mW/cm2, which does not exceed the FCC occupational MPE limit.

The formula for near-field, on-axis power density in front of the antenna is as follows:

$$S = 16 * e * P/ (pi * D2)$$

where "e" represents the antenna illumination efficiency and D is the antenna diameter.

In this case, when we apply illumination efficiency of 0.65, the result of the calculation is .9995 mW/cm2, which does not exceed the occupational MPE limit. As described earlier, though, the need for an unobstructed view to the satellites and sound engineering design obviates concern over actual exposure in this area. The calculated result here, however, is used in the analysis of potential exposure to the immediate side of the antenna, which is addressed in the subsection that follows.

Potential Exposure Levels to the Side of the Antenna

It is well understood that the near-field power density drops off dramatically outside the imaginary cylinder extending from the surface along the axis of the main beam of an aperture antenna.

According to the Bulletin OET 65, if the point of interest is at least one antenna diameter removed from the center of the main beam, the power density at that point would be at

least a factor of 100 lower that the value calculated for the equivalent distance in the main beam.

The previous calculation (for immediately in front of the antenna) demonstrated that the power density there is .9995 mW/cm2. At a distance of one antenna diameter (2.4 meters, or 7.874 feet) to the side of the antenna, the FCC model says that the RF level would be no more than 0.09995 mW/cm2.

Within the one-antenna-diameter distance to the side of the antenna, the near-field "1/distance" model applies. Applying simple proportions to the calculated levels at the edge of the antenna and at a lateral distance of one diameter indicates that the occupational limit is satisfied.

Note that this distance is within the area of the radome is less. Therefore, even if the MPE limit is exceeded in this limited area, the combination of restricted access and standard safety procedures is sufficient to assure compliance, even under the assumed worst-case (Platform mounted) VSAT conditions.

Compliance Conclusion

Based on the results of the calculations and consideration of access restrictions and standard safety procedures, it is our conclusion that the operation of Stratos' Ku-band 3.8 meter Hub antenna satisfy the compliance requirements in the FCC regulations.

Report prepared by:

Fred Davidson Hurst
Title: RF Engineer
Stratos Offshore Services Company
1710 West Willow Street
Scott, Louisiana 70583
Telephone: (337) 761-5431
fred.hurst@stratosglobal.com

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