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November 23, 2016

Ms. Marlene H. Dortch
Secretary
Federal Communications
Commission 445 12th Street, SW
Washington, D.C. 20554

Re: Astronics AeroSat Corporation – Section 1.65 Submission
File No. SES-MFS-20161003-00823 (Call Sign E140087)

Dear Ms. Dortch:

Astronics AeroSat Corporation ("Astronics AeroSat"), in connection with the above-referenced earth station aboard aircraft ("ESAA") blanket license modification application and pursuant to Section 1.65 of the Commission's Rules, 47 C.F.R. § 1.65, is writing to update and clarify certain information submitted in connection with its pending application.

Astronics AeroSat updates the record of this proceeding to clarify certain information associated with the request to add Yamal 300K satellite as an authorized point of communication. Yamal 300K is controlled and operated by Gazprom Space Systems ("GSS") at the 177° W.L. orbital location and operates under the Netherlands Administration's NSS-19 ITU network, which has been notified, recorded in the ITU's Master Register and successfully coordinated with the United States. Also, Astronics AeroSat's application erroneously indicates that the HR129 ESAA terminal will receive downlink communications from the Yamal 300K satellite throughout the 10.95-11.7 GHz band in the United States. Astronics AeroSat clarifies that such communications will be limited to the 10.95-11.2 GHz and 11.45-11.7 GHz sub-bands, which are authorized for ESAA receive operations on an unprotected basis.[1]

Astronics AeroSat also stated its in application that the HR129 terminal will receive downlink communications from the IS-29E satellite in the 12.2-12.5 GHz band, which was in error. Astronics AeroSat hereby clarifies that its ESAA terminals will not receive downlink transmissions from IS-29E in the 12.2-12.5 GHz band, which may be omitted from the frequencies associated with this satellite.

In addition, Astronics AeroSat seeks to clarify certain technical information provided in its application. Schedule B, Item 38, indicates an input power level of 25 W for the HR129 terminal, which represents the theoretical maximum input power level for the terminal. However, Astronics AeroSat will not operate the HR129 terminal at this level but instead will operate with a maximum input power of 11.75 W, well below the maximum input power indicated in the Schedule B. As demonstrated in the attached revised Radiation

[1] *See* 47 C.F.R. § 25.227; 47 C.F.R. § 2.106, footnote NG52.

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Hazard Report, there is no risk of excess human exposure to RF radiation given this operational limitation and the tail-mount location of the HR129 terminal approximately 25 feet above ground level.[2]

Finally, in the Schedule B, Item E40, Astronics AeroSat indicates an EIRP value of 42.5 dBW. In the Technical Description, Table 1, Astronics AeroSat lists an EIRP value of 41.9 dBW. Here, Astronics AeroSat clarifies that the 41.9 dBW EIRP value is consistent with the EIRP Density Plots provided in Section III of the Technical Appendix and otherwise ensures compliance with the Section 25.227(a)(1) of the Commission's Rules for operations within the United States. Accordingly, Astronics AeroSat confirms that the Schedule B, Item E40 value should be adjusted to 41.9 dBW.

Please do not hesitate to contact me with any questions regarding this matter.

Respectfully submitted,

Carlos M. Nalda
Principal
LMI Advisors

Cc (w/enclosures): Paul Blais
Trang Nguyen
Cindy Spiers

[2] Note the antenna height above ground level (AGL) indicates this tail-mount location. Astronics AeroSat notes that an AGL of "0" has also been used in ESAA applications to reflect the varying antenna heights associated with aircraft terminals.

IV. FCC RF Hazard Compliance Analysis

In connection with a license application by Astronics AeroSat Corp. for operation of a 0.29 Meter Ku-band aircraft remote antenna, the following assessment is provided of compliance with the FCC limits for maximum permissible exposure (MPE) to RF fields.

Based on the mathematical analyses described herein, the potential RF exposure levels in the areas of possible interest for antenna operation can be considered in compliance with the applicable FCC limits for controlled or occupational exposure (access to the earth station antenna is restricted to trained personnel) and for protection of the general population. The proposed operation is therefore in compliance with the FCC regulations and exposure limits.

The sections that follow provide the analysis and conclusions regarding compliance.

1 Operational Data

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

Transmitting Frequency Band:	14.0 – 14.5 GHz
Antenna Manufacturer / Model:	Astronics Aerosat / HR 129
Antenna Type:	Horn with Lens
Antenna Dimension:	0.29 meters (diameter) (11.4 inches)
Antenna Efficiency:	70 %
Net Power Input to Antenna (at flange):	11.75 Watts
Antenna Height AGL:	7.5 meters (24.6 feet)

2 Applicable MPE Limits

The MPE limits are described in the FCC Rules and Regulations. For the frequency range of interest here, the applicable limit for acceptable, continuous exposure of the general population is 1.0 milliwatt per square centimeter (mW/cm2), and for “controlled” occupational exposure, it is 5.0 mW/cm2. As is the case for all antennas in the Astronics AeroSat aircraft network, access to the antenna is restricted to trained personnel, and thus the latter limit is generally applicable. However, it is possible that untrained members of the general population could be within certain distances from the aircraft. Therefore, the MPE limit for the general population has also been examined.

3 FCC Formulas and Calculations

FCC Bulletin OET 65 provides standardized formulas for calculating the power density in the areas of interest here. Using the formulas from Bulletin OET 65, we report the exposure levels (1) directly in front of the antenna, (2) in the main beam at the transition from near to far field, and (3) farther away but still in the main beam where the MPE limit is met for both controlled and general population exposure; and (4) to the side of the antenna. Each area of interest will be addressed below and the results of the calculations are given.

3.1 Potential exposure level directly in front of the antenna

The worst-case possible exposure occurs right at the surface (aperture) of the antenna. According to Bulletin 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 11.75 Watts antenna of input power at the flange, an antenna diameter of 0.29 m (11.4 inches), the power density at the antenna surface is 71.37 mW/cm^2, which exceeds the 5.0 mW/cm^2 MPE limit for controlled access. However, there is no way to approach this close to the antenna when the aircraft is in flight. Furthermore, the antenna will be switched off completely (i.e. unpowered) when a technician needs to perform work in this area (which is more than 24 feet above ground level). Standard RF safety procedures will be applied and the power to the antenna will be removed during the period of the work.

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

$$S = 16 * \eta * P / (\pi * D^2)$$

Where: **P** represents the antenna input power**;**
η represents the antenna illumination efficiency; and,
D is the antenna diameter.

In this case, when we apply an illumination efficiency of 70 %, the result of the calculation is 50.00 mW/cm2, which exceeds the occupational MPE limit. This is the exposure level directly in front of the antenna at a distance of 1 m. For the reasons stated above, there is no way for a technician or the general public to approach this close to the antenna while it is transmitting.

We can calculate the distance at which the antenna emissions would meet the MPE limits for controlled access and for the general population using the following formula:

$$R_{MPE} = ((G * P) / (4 * \pi * MPE))^{1/2}$$

Where: **G** represents the Gain of the antenna;
P represents the antenna input power: and,
MPE represents the maximum permissible exposure limit.

The results of the analysis show that the MPE for controlled access are met at 5.0 m (16.3 feet) directly in front of the antenna. The MPE for the general population is met at 11.1 m (36.4 feet) directly in front of the antenna.

The results of this calculation are also used in the analysis of potential exposure to the immediate side of the antenna, which is addressed in the subsection that follows.

3.2 Potential exposure level to the side of the antenna

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 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 (20 dB) than the value calculated for the equivalent distance in the main beam.

In this particular case, the antenna is mounted 7.5 m (29 feet) above the ground. Therefore, the closest that ground personnel and passengers could approach an operational antenna would be at the very least 26 antenna diameters below the main beam.

The previous calculation of the power density immediately in the near field in front of the antenna) resulted in a value of 50.00 mW/cm2, Using the analysis provided in Bulletin OET 65, standing more than 26 antenna diameters off axis would decrease the exposure level by at least 34 dB to where the power density on the ground below the tail mounted antenna was less than 4 % of the MPE for the general population. It is highly unlikely that the general population would ever be permitted to approach the tail of an operational aircraft that closely. Even so, the exposure level at that distance complies with the MPE requirements. At any greater distance (such as boarding the aircraft), the exposure level would be lower still.

4 Compliance Conclusion

Astronics AeroSat will observe standard safety precautions with respect to operations and maintenance of the HR129 antenna, including powering the antenna off in advance of maintenance activities. In addition, given the location of the antenna on the top of the T-tail of business jets, there is no possibility that members of the general public will be located in regions where MPE values may be exceeded.

Based on the result of the analysis with regard to the potential exposure levels in all respects – directly in front of the antenna, to the side of the antenna, and at ground level – and taking into account the access restrictions for both trained and un-trained persons and standard safety procedures, we conclude that the operation of the Astronics AeroSat 0.29 meter Ku-band antenna as a tail-mounted aircraft antenna satisfies the MPE compliance requirements in the FCC regulations.

Report prepared by

Dr. Robert Hanson
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