FCC RF Hazard Compliance Analysis
Prepared by
MTN License Corporation
Intellian V110 Ku-band ESV Operation

In connection with a license application by MTN License Corp. (**MTN**) for operation of a new 1.05 Meter Ku-band ESV 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 all areas of possible interest are in compliance with the applicable FCC limit for controlled or occupational exposure. (Access to the earth station antenna is restricted to trained personnel). 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:	Intellian V110
Antenna Type:	Prime Focus
Antenna Dimension:	1.05 meters (diameter) (20 feet)
Antenna Efficiency:	55 %
Net Power Input to Antenna (at flange):	4.5 Watts
Antenna Height AGL:	10.0 meters (32.8 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 MTN ESV network, access to the antenna is restricted to trained MTN personnel, and thus the latter limit applies.

3 FCC Formulas and Calculations

FCC Bulletin OET 65 provides standardized formulas for calculating the power density in both of the areas of 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 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 OET65, 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 4.5 Watts antenna of input power at the flange, an antenna diameter of 1.05 m (3.4 feet), the power density at the antenna surface is 2.08 mW/cm^2, which is lower than the 5.0 mW/cm^2 MPE limit. Even so, when a technician needs to perform work in this area (which is more than 11 feet above ground level), standard RF safety procedures will be applied and 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: **η** represents the antenna illumination efficiency; and,
D is the antenna diameter.

In this case, when we apply an illumination efficiency of 55%, the result of the calculation is 1.14 mW/cm2, which satisfies the occupational MPE limit. The calculated result here is 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 OET65, 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.

The previous calculation of the power density immediately in front of the antenna) resulted in a value of 1.14 mW/cm2, which is equivalent to 22.84% of the limit and is in compliance. Since the RF levels outside the hypothetical cylinder extending from the aperture is lower than inside the cylinder, the RF levels to the side of the antenna are clearly in compliance as well, and at ground level (32.8 feet below) the RF levels would be lower still.

4 Compliance Conclusion

Based on the result of the analysis with regard to the potential exposure levels in all respects – at the aperture of the antenna, to the side of the antenna, and at ground level – and taking into account the access restrictions and standard safety procedures, we conclude that the operation of the Intellian V110 1.05 meter Ku-band antenna as an ESV satisfies the MPE compliance requirements in the FCC regulations.

Report prepared by

Robert Hanson
Vice President Regulatory Affairs
MTN Satellite Communications
3020 N Commerce Parkway
Miramar, FL 33025

FCC RF Hazard Compliance Analysis
Prepared by
MTN License Corporation
Thrane & Thrane Sailor 900 Ku-band ESV Operation

In connection with a license application by MTN License Corp. (**MTN**) for operation of a new 1.03 Meter Ku-band ESV 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 all areas of possible interest are in compliance with the applicable FCC limit for controlled or occupational exposure. (Access to the earth station antenna is restricted to trained personnel). 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.

5 Operational Data

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

Transmitting Frequency Band:	14.0 – 14.5 GHz
Antenna Manufacturer / Model:	Sailor 900
Antenna Type:	Prime Focus
Antenna Dimension:	1.03 meters (diameter) (3.4 feet)
Antenna Efficiency:	58 %
Net Power Input to Antenna (at flange):	5.66 Watts
Antenna Height AGL:	10.0 meters (32.8 feet)

6 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 MTN ESV network, access to the antenna is restricted to trained MTN personnel, and thus the latter limit applies.

7 FCC Formulas and Calculations

FCC Bulletin OET 65 provides standardized formulas for calculating the power density in both of the areas of 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 addressed below and the results of the calculations are given.

7.1 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 OET65, 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 5.66 Watts of input power at the flange, an antenna diameter of 1.03 m (3.4 feet), the power density at the antenna surface is 2.72 mW/cm^2, which is lower than the 5.0 mW/cm^2 MPE limit. Even so, when a technician needs to perform work in this area (which is more than 11 feet above ground level), standard RF safety procedures will be applied and 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: **η** represents the antenna illumination efficiency; and,
D is the antenna diameter.

In this case, when we apply an illumination efficiency of 55%, the result of the calculation is 1.59 mW/cm2, which satisfies the occupational MPE limit. The calculated result here is also used in the analysis of potential exposure to the immediate side of the antenna, which is addressed in the subsection that follows.

7.2 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 OET65, 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.

The previous calculation of the power density immediately in front of the antenna) resulted in a value of 1.59 mW/cm2, which is equivalent to 31.77% of the limit and is in compliance. Since the RF levels outside the hypothetical cylinder extending from the aperture is lower than inside the cylinder, the RF levels to the side of the antenna are clearly in compliance as well, and at ground level (32.8 feet below) the RF levels would be lower still.

8 Compliance Conclusion

Based on the result of the analysis with regard to the potential exposure levels in all respects – at the aperture of the antenna, to the side of the antenna, and at ground level – and taking into account the access restrictions and standard safety procedures, we conclude that the operation of the Thrane & Thrane Sailor 900 1.03 meter Ku-band antenna as an ESV satisfies the MPE compliance requirements in the FCC regulations.

Report prepared by

Robert Hanson
Vice President Regulatory Affairs
MTN Satellite Communications
3020 N Commerce Parkway
Miramar, FL 33025