Radiation Hazard Assessments TX (RHATX)

GetSAT SlingBlade KA LM/LW Antenna terminal

Document # Getsat_SBKA_RHATX-230525-1 Version 1.0

23/05/25

Proprietary Notice

The information and ideas contained herein are proprietary to GetSAT communications Ltd. and shall not be duplicated or disclosed outside the receiving organization or the receiving organization's potential customer without prior written approval from GetSAT communications LTD., nor used by the receiving organization or any of its subsidiaries or affiliates, for any purpose other than evaluation of the ideas and work contained herein

any data contained in this document shall not be: (i) used for purposes other than the purposes explicitly agreed under the agreement addressing the provisions of this documents; (ii) copied or duplicated; (iii) reverse engineered or de-compiled, modified or revised; or (iv) used in any illegal manner or in any way that infringes any right of any third party including the rights in connection with privacy and intellectual property rights. (v) used to copy, modify, or create derivative works or improvements of the documents or products related thereto; (vi) used to access or use the products related thereto for purposes of competitive analysis of such product, the development, provision or use of a competing software service or product or any other purpose that is to Get Sat's detriment or commercial disadvantage; (vii) any trademarks, specifications, documentation, warranties or disclaimers, or any copyright, trademark, patent or other intellectual property or proprietary rights notices shall not be removed, deleted, altered or obscured from any document, product related thereto or deliverable or any part thereof or any other materials provided by Get Sat, including any copy thereof. (vii) any export control rule, law or regulation applicable to the documents or products related thereto shall not be infringed or breached.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. ABSTRACT

This document is a summary of calculations determining the radiation exposure at varying elevation angles of the Getsat SlingBlade KA Terminal PN SBKA-LM or SBKA LW for the purpose of documenting the minimum safe distance from the Tx Antenna at which the occupational power density of 5 mW/cm2, and the general public power density of 1 mW/cm2, is expected under worst case conditions. Power density safe exposure thresholds and time limits are determined using Health Canada (HC) and Federal Communications Commission (FCC) guidelines.

1.1 REVISION HISTORY

Table 1: Revision history

Release	Date	Author	Description
Ver 1.0	May 23, 2025	Oleg Roitberg	Version 1.0

1.1 APPROVALS

Table 2: Approvals

Approved by	Date	Name	Signature
CTO	May 23, 2025	Oleg Roitberg	

2. General

2.1 Scope

This document covers the radiation hazard analysis for the GETSAT SlingBlade KA Transmit Antenna PN SBKA-LM, where 'V2' refers to antenna version.

Any PN numbered configuration as defined in Table 3.

Part Number	Description
SBKA-LM	Sling Blade KA LM configuration
SBKA-LW	Sling Blade KA LW configuration

Table 3: Antenna Configurations

3. Reference Documents

Documents in Table 4 form a part of this document to the extent specified herein.

Document Number	Title
Health Canada, Safety Code 6, 2015	Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 2 kHz to 300 GHz
FCC OET Bulletin 65, Edition 97-01, August 1997	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
ICNIRP Guidelines– 1998	ICNIRP Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields (Up to 300 GHz), 1998

Table 4: Tx antenna Configurations

4. Maximum Permissible Exposure Limits

Maximum Permissible Exposure (MPE) is defined in terms of power density (S), electric field strength (E) and magnetic field strength (H) where these quantities are related by equation (1).

$$S = EH = E^2/3770 = 37.7H^2$$

Table 3.0-1 lists time exposure limits and power density limits defined in FCC OET Bulletin 65, Health Canada Safety Code 6 and ICNIRP Guidelines

FCC Guidelines		
Category	**Time Limit (min)**	**Power Density Limit (mW/cm2)**
Occupational/Controlled Environment	6	5
General Population/Uncontrolled Environment	30	1
HC Guidelines		
Category	**Time Limit (min)**	**Power Density Limit (mW/cm2)**
Occupational/Controlled Environment	2.6	5
General Population/Uncontrolled Environment	2.6	1
ICNIRP Guidelines		
Category	**Time Limit (min)**	**Power Density Limit (mW/cm2)**
Occupational/Controlled Environment	N/A	5
General Population/Uncontrolled Environment	N/A	1

Table 5: Maximum Permissible Exposure Limits

Occupational exposure limits are considered for maintenance crew, any crew member standing on top of the aircraft fuselage, adults who are generally exposed under known conditions and are trained to be aware of potential risk and to take appropriate precautions or for any other controlled situation. General population exposure limits are considered for individuals of all ages and of varying health status, all bystanders beneath the aircraft, bystanders in the aircraft terminal, members of the public unaware of their exposure to EMF who cannot reasonably take precautions to minimize or avoid exposure or for any other uncontrolled situation.

5. Analysis

5.1 Scope

The On-Axis Power density analysis employs a high-fidelity Fresnel zone model and assumes a 100% duty cycle. The Fresnel zone is the 3D elliptical region between the transmit antenna and the receive antenna, Figure 1, where R is the distance from the Tx Antenna along the LOS.

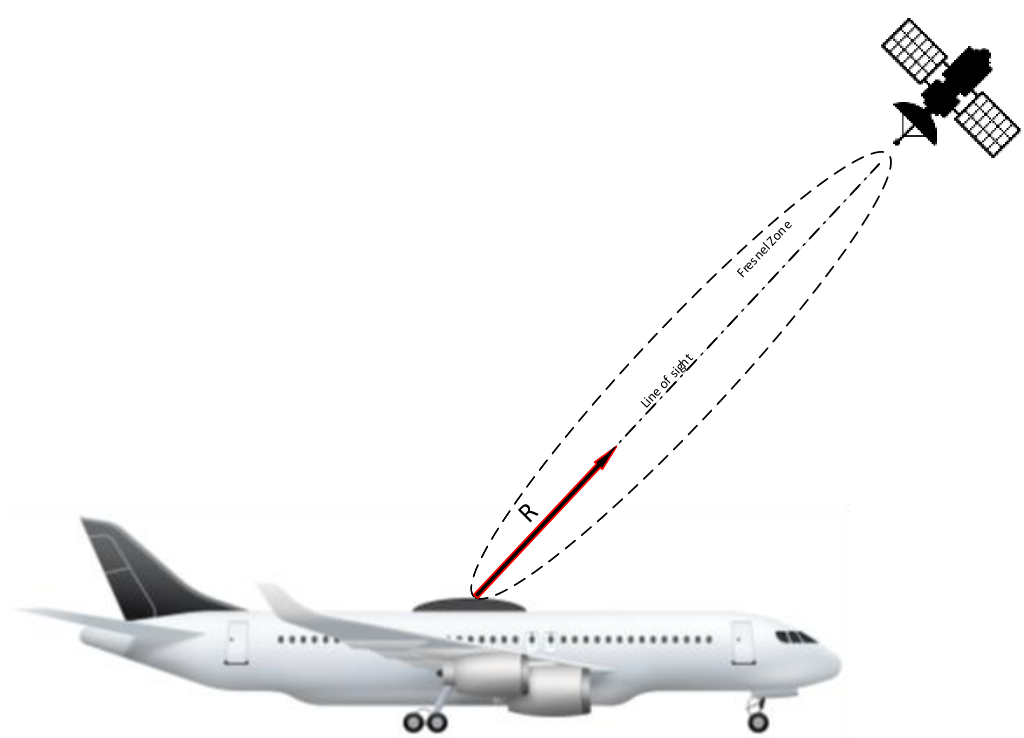

Figure 1: Fresnel Zone, Reference Only

The parameters in Table 4.1-1 are used to calculate power-density for an elevation range of 0°-90°.

Parameter	Value	Unit
Azimuth Beamwidth	1.4	°
Frequency	30.0	GHz
Antenna I2R Power loss	Radome Loss – 1	dB
Antenna Power (EIRP max)	49	dbW

Table 6: Parameters for Power-Density Calculations

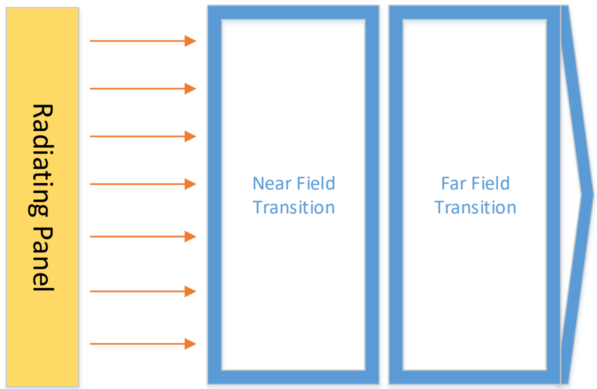

Figure 2: Analyzed zones

Next figures representing the maximum power density vs distance at various elevation angle.

Elevation is calculated for 90°,75°,60°,45°,30°,15° and 0° scenarios with PSAT max power transmission.

5.2 On Axis Elevation 90° @ EIRP of 49 dBW

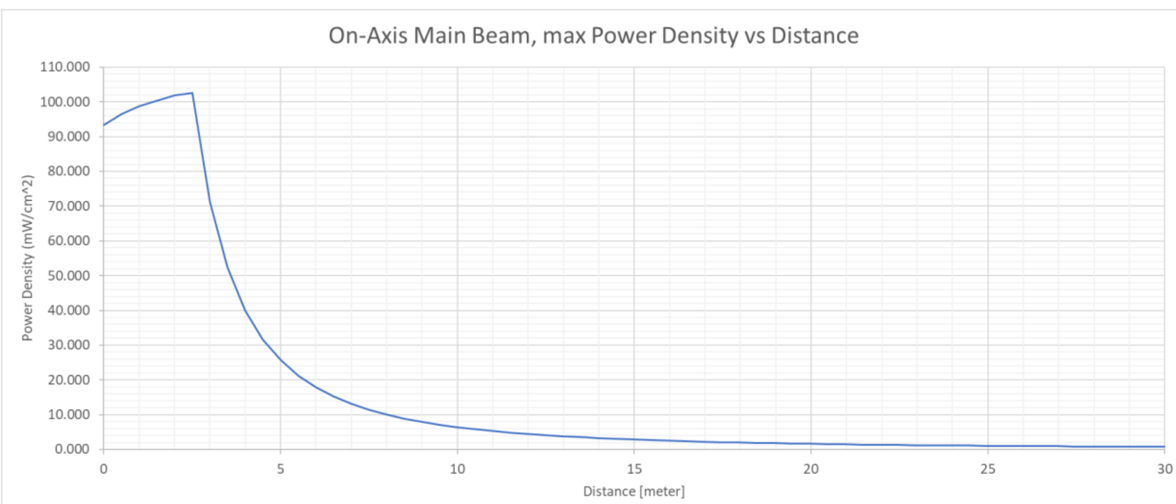

Figure 3: Power Density vs Distance at 90° Elevation

5.3 ON AXIS ELEVATION 75° @ EIRP OF 48.50 DBW

Analyzed data:

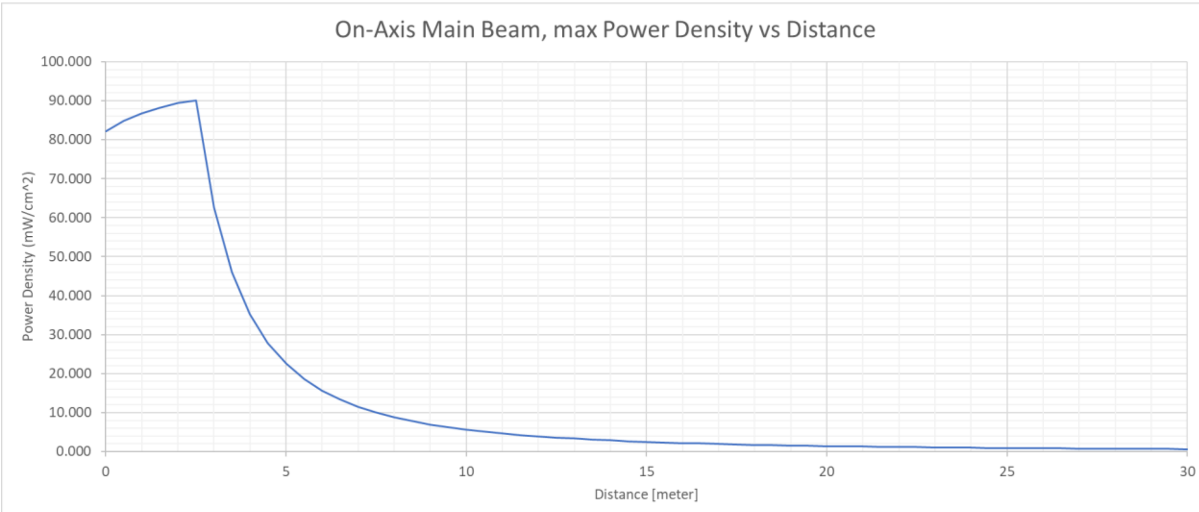

Figure 4: Power Density vs Distance at 75° Elevation

5.4 ON AXIS ELEVATION 60° @ EIRP OF 48 DBW

Analyzed data:

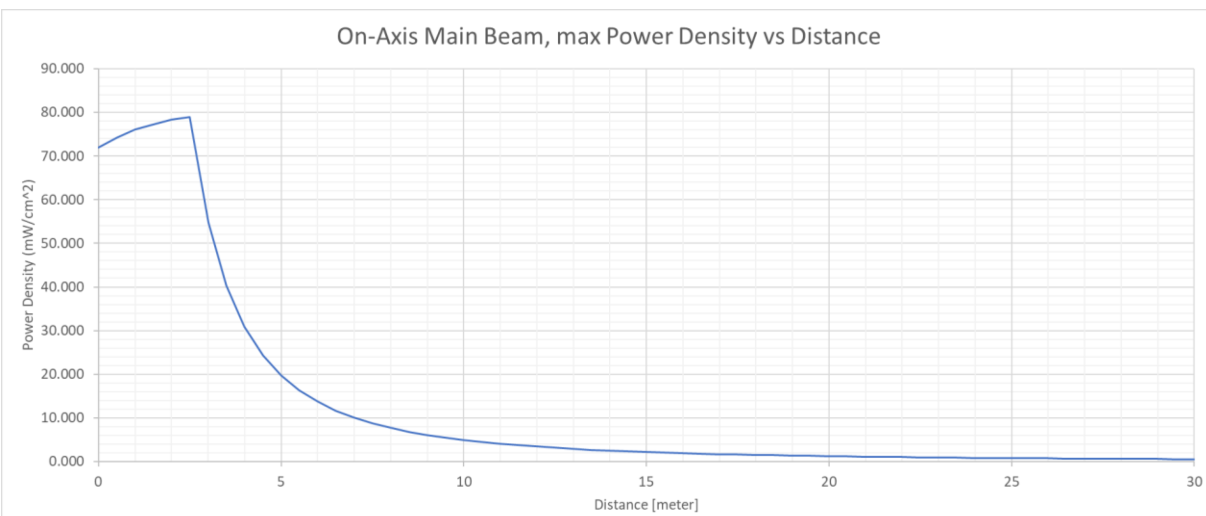

Figure 5: Power Density vs Distance at 60° Elevation

5.5 On Axis Elevation 45° @ EIRP of 47.0 dBW

Analyzed data:

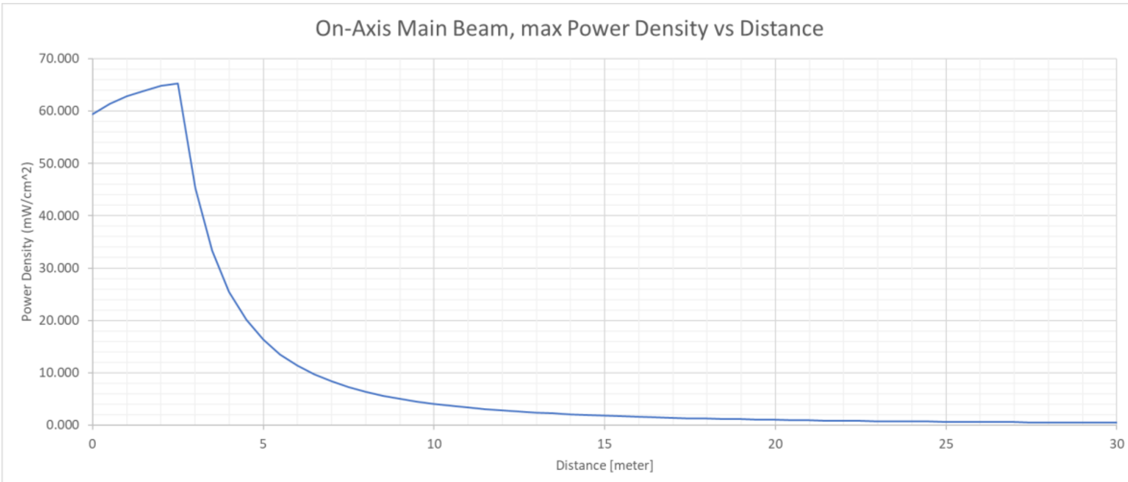

Figure 6: Power Density vs Distance at 45° Elevation

5.6 On Axis Elevation 30° @ EIRP of 45.5 dBW

Analyzed data:

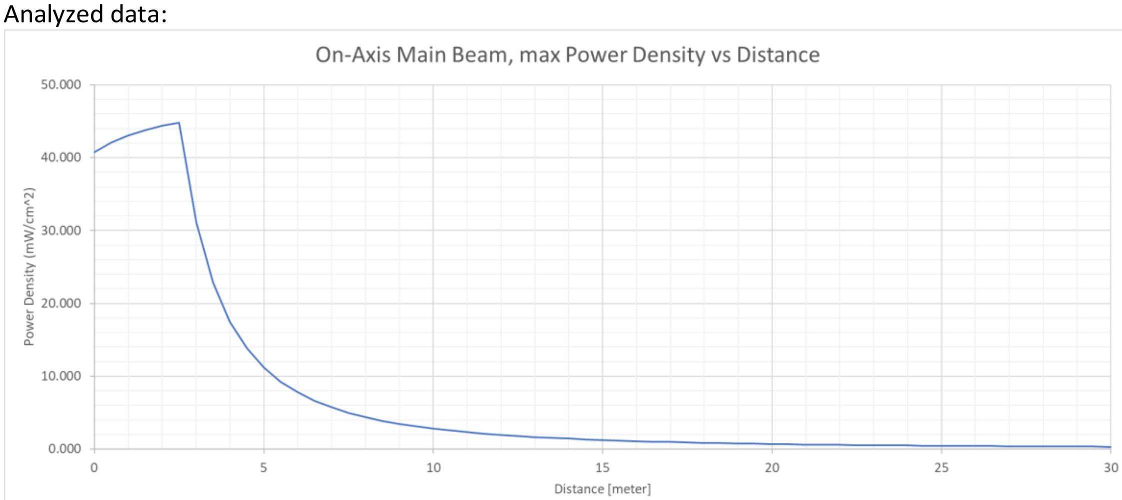

Figure 7: Power Density vs Distance at 30° Elevation

5.7 On Axis Elevation 15° @ EIRP of 43 dBW

Analyzed data:

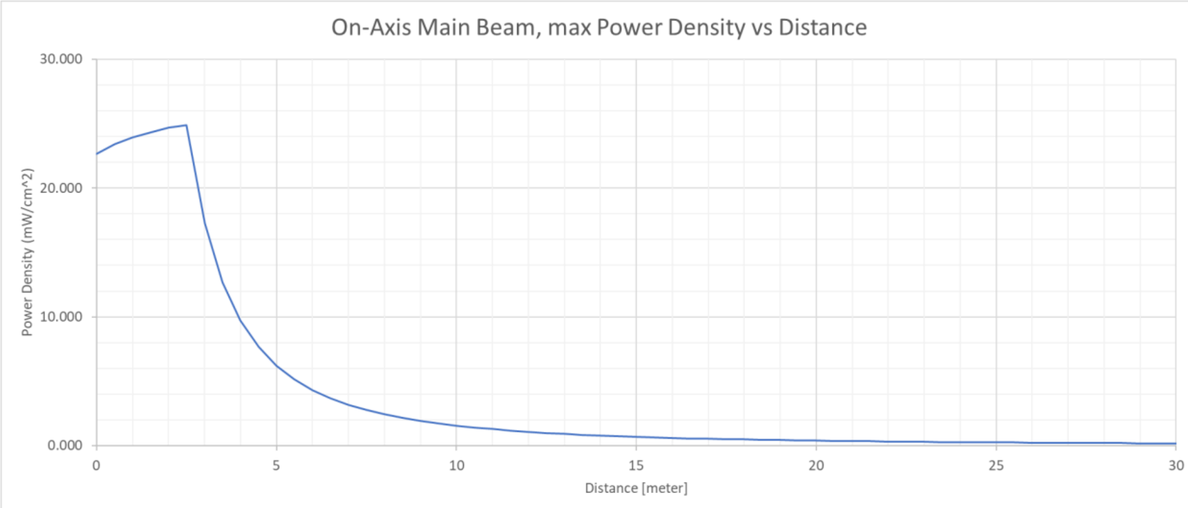

Figure 8: Power Density vs Distance at 15° Elevation

5.8 On Axis Elevation 0° @ EIRP of 29 dBW

Analyzed data:

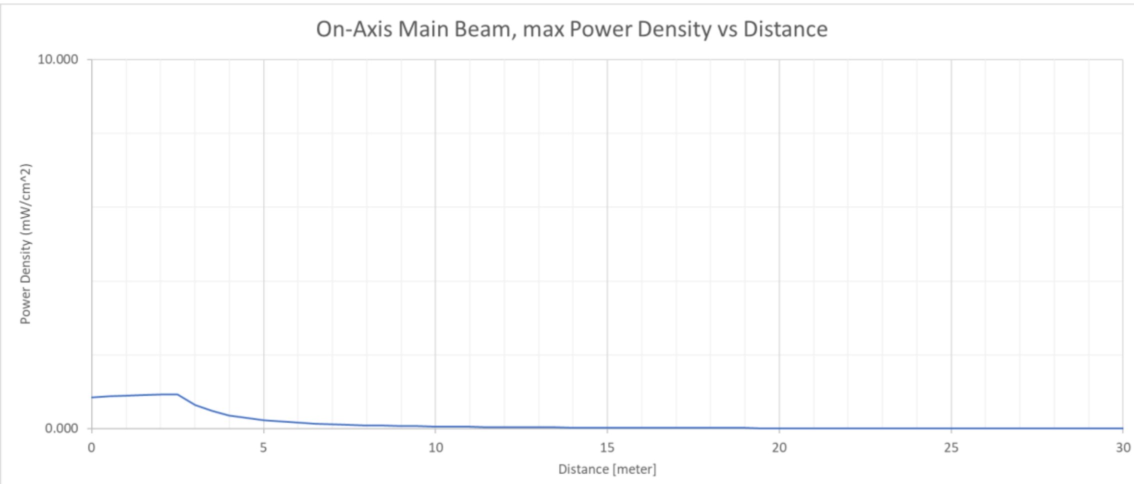

Figure 9: Power Density vs Distance at 0° Elevation

5.9 Scope

Minimum safe distance from the antenna is defined in terms of vertical proximity and horizontal proximity, parameters are shown in Figure 10.

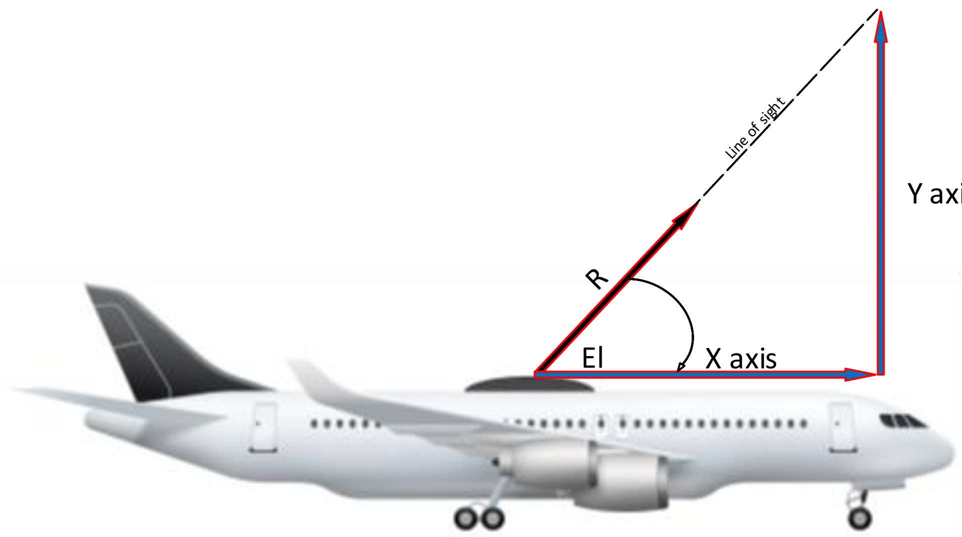

Figure 10: Minimum Safe Distance

Analyzing the power density plots, R values for the distance from the Tx Antenna where power density is 5 mw/cm2 and 1 mw/cm2 are listed in Table 7 and Table 8, respectively.

X axis Proximity of the Power density equals to Rmax * Cos (El)
Y axis Proximity of the Power density equals to Rmax * Sin (El)

El (°)	**Elevation Beam Width BW (°)**	**EIRP (dBW)**	**R @5 mw/cm2 (meters)**	**Y axis, Vertical Proximity @5 mw/cm2 (meters)**	**X axis, Horizontal Proximity @5 mw/cm2 (meters)**
90	1.4	49	11.5	11.5	0
75	1.5	48.5	10.5	10.14	2.7
60	1.6	48	10	8.66	5
45	2	47	9	6.36	6.36
30	3	45.5	7	3.5	6.06
15	6	43	5.5	1.42	5.31
0	11	29	0	0	0

Table 7: Safe Distances with 5 mw/cm2 On-Axis Power-Density, FCC Occupational Exposure

El (°)	Elevation Beam Width BW (°)	EIRP (dBW)	R @1 mw/cm2 (meters)	Y axis, Vertical Proximity @1 mw/cm2 (meters)	X axis, Horizontal Proximity @1 mw/cm2 (meters)
90	1.4	49	23	23	0
75	1.5	48.5	21	20.28	5.4
60	1.6	48	20.5	17.75	10.25
45	2	47	18	12.72	12.72
30	3	45.5	15.5	7.75	13.42
15	6	43	12	3.1	11.59
0	11	29	0	0	0

Table 8: Safe Distances with 1 mw/cm2 On-Axis Power-Density, FCC General Population Exposure

6. Discussion

6.1 Occupational Exposure

Occupational exposure safe distances for all elevation angles are defined in Table 4.2-1. The following real life "controlled" situations were evaluated and discussed:

1) A maintenance member standing on top of the aircraft fuselage.
2) A maintenance member directly above the antenna, for situations such as de-icing.

6.1.1 Maintenance Member Standing on top of the Aircraft Fuselage or any installation surface

Presuming that the system is transmitting at 100% duty factor, at its worst case possible the TX antenna power level up to 43.0dbW (including 1db radome loss), with the antenna beam directly pointed in azimuth and pointed in elevation 15° (worst case) at a 1.8 m tall crewmember standing on top of the aircraft fuselage or any surface the antenna is installed, the safe vertical proximity is 1.8 m from the center of the transmitting antenna and the safe horizontal proximity is 6.7m from the center of the transmitting antenna. Calculations are based on the parameters outlined in Table 9. And worst case terminal and crewmember standing on the same level

Parameter	**Value**	**Unit**
Azimuth Beamwidth	1.4	°
Elevation Beamwidth	6	°
Frequency	30.0	GHz
Antenna I2R Power loss	Radome Loss – 1	dB
Antenna Power (EIRP max)	43	dbW
Maximum Safe Exposure	5	mW/cm2

Table 9: Safe Power Density and Safe Distance Calculation Parameters @ 15° El, Occupational Exposure

It should be noted that, as an additional interlock safety feature and for practical scenarios in which the antenna is powered on but the line-of-sight to the intended satellite is blocked by objects or personnel, RF emissions are proactively inhibited. The transmit panel will automatically mute in the absence of a reliable receive signal from the satellite therefore disabling all transmission from the antenna.

6.1.2 Maintenance Member Directly Above the Antenna

Presuming that the system is transmitting at 100% duty factor, at its worst case possible the TX antenna power level up to 49dbW (including 1db radome loss), with the antenna beam directly pointed in azimuth and pointed in elevation 90° at a crewmember above the antenna, the safe vertical proximity is 11.5m (according Table 7) from the center of the transmitting antenna and the safe horizontal proximity is 0.0 m (0.0 ft) from the center of the transmitting antenna. Calculations are based on the parameters outlined in Table 10.

Parameter	**Value**	**Unit**
Azimuth Beamwidth	1.4	°
Elevation Beamwidth	1.4	°
Frequency	30.0	GHz
Antenna I2R Power loss	Radome Loss – 1	dB
Antenna Power (EIRP max)	49	dbW
Maximum Safe Exposure	5	mW/cm2

Table 10: Power Density and Safe Distance Calculation Parameters @ 90° El, Occupational Exposure

It should be noted that, as an additional interlock safety feature and for practical scenarios in which the antenna is powered on but the line-of-sight to the intended satellite is blocked by objects or personnel during situations like de-icing, RF emissions are proactively inhibited. The transmit panel will automatically mute in the absence of a reliable receive signal from the satellite therefore disabling all transmission from the antenna.

6.2 Bystander Standing Below the Crown of the Aircraft Fuselage

General population exposure safe distances for all elevation angles are defined in Table 8. The following real life "un-controlled" situations were evaluated and discussed:

1) A bystander standing below the crown of the aircraft fuselage.
2) A bystander standing in the aircraft terminal.

6.2.1 Maintenance Member Directly Above the Antenna

The Tx Antenna will not (cannot) scan below the crown of the fuselage due to mechanical constraints. Presuming that the system is transmitting at 100% duty factor, at its worst case possible TX antenna power level up to 29.0dbW (including 1db radome loss), with the antenna beam pointed in azimuth and pointed in the supposed lowest elevation of 0° towards a bystander standing below the crown the aircraft fuselage, the safe vertical proximity is 0.0m from the center of the transmitting antenna and the safe horizontal proximity is 0.0m. Calculations are based on the parameters outlined in Table 11.

Parameter	Value	Unit
Azimuth Beamwidth	1.4	°
Elevation Beamwidth	11	°
Frequency	30.0	GHz
Antenna I2R Power loss	Radome Loss – 1	dB
Antenna Power (EIRP max)	29	dbW
Maximum Safe Exposure	1	mW/cm2

Table 11: Power-Density and Safe Distance Calculation Parameters @ 0° El, General Population Exposure

6.2.2 Maintenance Bystander Standing in the Aircraft Terminal, 15° El

Presuming that the system is transmitting at 100% duty factor, at its worst-case possible TX antenna power level up to 43.0dbW (including 1db radome loss), with the antenna beam directly pointed in azimuth and in elevation 15° at a bystander standing in the aircraft terminal, the safe vertical proximity is 3.1 m from the center of the transmitting antenna and the safe horizontal proximity is 12 m. Calculations are based on the parameters outlined in Table 12.

Parameter	Value	Unit
Azimuth Beamwidth	1.4	°
Elevation Beamwidth	6	°
Frequency	30	GHz
Antenna I2R Power loss	Radome Loss – 1	dB
Antenna Power (EIRP max)	43	dbW
Maximum Safe Exposure	1	mW/cm2

Table 12: Power-Density and Safe Distance Calculation Parameters @ 15° El, General Population Exposure

It should be noted that, as an additional interlock safety feature and for practical scenarios in which the antenna is powered on but the line-of-sight to the intended satellite is blocked by objects like aircraft terminal buildings, RF emissions are proactively inhibited. The Tx antenna will automatically mute in the absence of a reliable receive signal from the satellite therefore disabling all transmission from the antenna.

6.2.3 Maintenance Bystander Standing in the Aircraft Terminal, 30° El

Presuming that the system is transmitting at 100% duty factor, at its worst-case possible TX antenna power level up to 45.5dbW (including 1db radome loss), with the antenna beam directly pointed in azimuth and in elevation 30° at a bystander standing in the aircraft terminal, the safe vertical proximity is 7.75 m from the center of the transmitting antenna and the safe horizontal proximity is 13.42 m. Calculations are based on the parameters outlined in Table 13.

Parameter	Value	Unit
Azimuth Beamwidth	1.4	°
Elevation Beamwidth	3	°
Frequency	30	GHz
Antenna I2R Power loss	Radome Loss – 1	dB
Antenna Power (EIRP max)	45.5	dbW
Maximum Safe Exposure	1	mW/cm2

Table 13: Power-Density and Safe Distance Calculation Parameters @ 30° El, General Population Exposure

6.2.4 Maintenance Bystander Standing in the Aircraft Terminal, 45° El

Presuming that the system is transmitting at 100% duty factor, at its worst-case possible TX antenna power level up to 47dbW (including 1db radome loss), with the antenna beam directly pointed in azimuth and in elevation 45° at a bystander standing in the aircraft terminal, the safe vertical proximity is 12.72 m from the center of the transmitting antenna and the safe horizontal proximity is 12.72 m. Calculations are based on the parameters outlined in Table 14.

Parameter	Value	Unit
Azimuth Beamwidth	1.4	°
Elevation Beamwidth	2	°
Frequency	30.0	GHz
Antenna I2R Power loss	Radome Loss – 1	dB
Antenna Power (EIRP max)	47	dbW
Maximum Safe Exposure	1	mW/cm2

Table 14: Power-Density and Safe Distance Calculation Parameters @ 45° El, General Population Exposure

6.2.5 Maintenance Bystander Standing in the Aircraft Terminal, 60° El

Presuming that the system is transmitting at 100% duty factor, at its worst-case possible TX antenna power level up to 48dbW (including 1db radome loss), with the antenna beam directly pointed in azimuth and in elevation 60° at a bystander standing in the aircraft terminal, the safe vertical proximity is 17.75 m from the center of the transmitting antenna and the safe horizontal proximity is 10.25 m. Calculations are based on the parameters outlined in Table 14.

Parameter	**Value**	**Unit**
Azimuth Beamwidth	1.4	°
Elevation Beamwidth	1.6	°
Frequency	30	GHz
Antenna I2R Power loss	Radome Loss – 1	dB
Antenna Power (EIRP max)	48	dbW
Maximum Safe Exposure	1	mW/cm2

Table 15: Power-Density and Safe Distance Calculation Parameters @ 60° El, General Population Exposure

6.2.6 Maintenance Bystander Standing in the Aircraft Terminal, 75° El

Presuming that the system is transmitting at 100% duty factor, at its worst-case possible TX antenna power level up to 48.5dbW (including 1db radome loss), with the antenna beam directly pointed in azimuth and in elevation 75° at a bystander standing in the aircraft terminal, the safe vertical proximity is 20.28 m from the center of the transmitting antenna and the safe horizontal proximity is 5.43 m. Calculations are based on the parameters outlined in Table 14.

Parameter	**Value**	**Unit**
Azimuth Beamwidth	1.4	°
Elevation Beamwidth	1.5	°
Frequency	30.0	GHz
Antenna I2R Power loss	Radome Loss – 1	dB
Antenna Power (EIRP max)	48.5	dbW
Maximum Safe Exposure	1	mW/cm2

Table 16: Power-Density and Safe Distance Calculation Parameters @ 75° El, General Population Exposure

6.2.7 Maintenance Bystander Standing in the Aircraft Terminal, 90° El

Presuming that the system is transmitting at 100% duty factor, at its worst-case possible TX antenna power level up to 49dbW (including 1db radome loss), with the antenna beam directly pointed in azimuth and in elevation 90° at a bystander standing in the aircraft terminal, the safe vertical proximity is 23 m from the center of the transmitting antenna and the safe horizontal proximity is 0 m. Calculations are based on the parameters outlined in Table 14.

Parameter	Value	Unit
Azimuth Beamwidth	1.4	°
Elevation Beamwidth	1.4	°
Frequency	30.0	GHz
Antenna I2R Power loss	Radome Loss – 1	dB
Antenna Power (EIRP max)	49	dbW
Maximum Safe Exposure	1	mW/cm2

Table 17: Power-Density and Safe Distance Calculation Parameters @ 90° El, General Population Exposure

7. Conclusion

Considering all real-life situations for occupational and general population RF emission exposure, minimum RF exposure time limits, power density limits and minimum safe distances are defined in Table 6.0-1.

Category	Time Limit	Power Density Limit	Elevation pointing	Safe Vertical Proximity	Safe Horizontal Proximity
Occupational/Controlled	2.6 min	5 mW/cm2	**0**	**0 m**	**0**
			15	**1.4 m**	**5.31m**
			45	**6.36m**	**6.36m**
			90 (boresight)	**11.5 m**	**0 m**
General Population/Uncontrolled	2.6 min	1 mW/cm2	**0**	**0 m**	**0**
			15	**3.1 m**	**11.59 m**
			45	**12.72 m**	**12.72 m**
			90 (boresight)	**23m**	**0 m**

Table 18: Minimum Safe RF Exposure Parameters