



RF Exposure Evaluation Report

APPLICANT	NAVICO RBU ITALIA S.R.L.
ADDRESS	VIA ROMITA, 26 MONTAGNANA VAL di PESA, MONTESPERTOLI, FIRENZE 50025 ITALY
FCC ID	2AJJ3SRTLAN25X
IC	21849-SRTLAN25X
MODEL NUMBER	SRTLAN25X
PRODUCT DESCRIPTION	X-BAND RADAR
DATE SAMPLE RECEIVED	10/31/2018
FINAL TEST DATE	11/17/2018
PREPARED BY	Franklin Rose

Report Number	Report Version	Description	Issue Date
1830AUT18 MPE_TestReport_	Rev1	Initial Issue	02/13/2018
1830AUT18 MPE_TestReport_	Rev2	Updated MPE Distance	02/15/2018
1830AUT18 MPE_TestReport_	Rev3	Corrected Duty Cycle	02/18/2018

THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.

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GENERAL REMARKS

Summary

The device under test does:

- ☒ Fulfill the general approval requirements as identified in this test report and was selected by the customer.
- ☐ Not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that the necessary measurements were made at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669
Designation #: US1070

Prepared by:



Name and Title	Franklin Rose, EMC Project Manager / EMC Specialist
Date	01/28/2018

Applicant: NAVICO RBU ITALIA S.R.L.
FCC ID: 2AJJ3SRTLAN25X
IC: 21849-SRTLAN25X
Report: 1830AUT18_MPE TestReport_Rev3

GENERAL INFORMATION

EUT Description	X-BAND RADAR		
Model Number	SRTLAN25X		
EUT Power Source	<input checked="" type="checkbox"/> 110–120 VAC	<input type="checkbox"/> DC Power (12 V)	<input type="checkbox"/> Battery Operated
Test Item	<input type="checkbox"/> Prototype	<input checked="" type="checkbox"/> Pre-Production	<input type="checkbox"/> Production
Type of Equipment	<input checked="" type="checkbox"/> Fixed	<input type="checkbox"/> Mobile	<input type="checkbox"/> Portable
Antenna Connector	WR-90 Waveguide		
Test Conditions	The temperature was 26°C Relative humidity of 50%.		
Modification to the EUT	No Modification to EUT.		
Applicable Standards	FCC CFR 47 Part 2.1091		
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA. Designation #: US1070		

NOTES:

At present, the radar is manufactured in two models, "Upmast" and "Downmast".

The Upmast model is a radar transceiver fully housed within the antenna pedestal, intended to be mounted at a sufficiently high elevation on the vessel.

The Downmast model houses the transceiver separately at a moderate location on the vessel, and the emission is conducted to the antenna pedestal, mounted at a sufficiently high elevation on the vessel.

In all cases, the radar equipment is intended for controlled/occupational use and access only. General population MPE distances have also been provided, for reference.

The diagrams in this report visually represent the calculated MPE standoffs for a) each antenna type, and b) the equipment itself, outside the antenna's line of sight.

Downmast equipment's MPE distance is equivalent to the "Outside Beam" MPE distances.

ANTENNA INFORMATION

This information was provided by the client:

	6 ft X-Band	9 ft X-Band	12 ft X-Band	12 ft S-Band
Antenna type	End-fed-slotted wave guide			
Polarization	Horizontal			
Antenna length/swing circle (ft/mm)	6 / 1800	9 / 2650	12 / 3618	12 / 3695
Gain (dB)	≥ 29	≥ 31	≥ 32.5	≥ 27
Horizontal beam width at -3 dB	1.3°	0.9°	0.7°	1,9
Vertical beam width at -3 dB	22°	22°	22°	24
Horizontal side lobes (dB):				
- within 10°	- 27	- 27	- 27	- 23
- outside 10°	- 30	- 30	- 30	- 30
VSWR	Lower than 1.20			

Manufacturer-Provided Antenna	Type	Max Gain (dBi)
6 ft. X-Band	End-fed Slotted Waveguide	29.0
9 ft. X-Band	End-fed Slotted Waveguide	31.0
12 ft. X-Band	End-fed Slotted Waveguide	32.5

MPE CALCULATION

The minimum separation distance is calculated as follows:

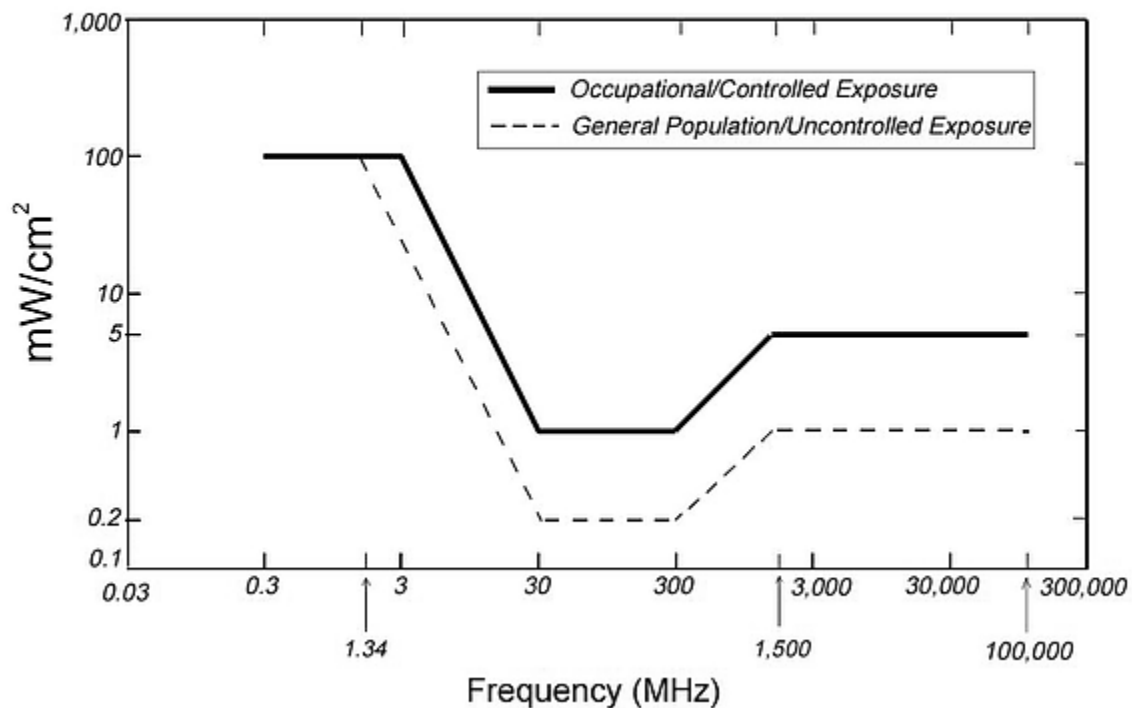
$$E(V/m) = \frac{\sqrt{30 \times P \times G}}{d}$$

$$\text{Power density: } P_d (mW/cm^2) = \frac{E^2}{3770}$$

MPE LIMITS

Figure 1. FCC Limits for Maximum Permissible Exposure (MPE)

Plane-wave Equivalent Power Density



MPE DATA

FCC MPE Calculation: 6 ft. X-Band Antenna

Inside Beam (< 1.3° Horizontal Polarity, < 22° Vertical Polarity)

1. **General Uncontrolled Exposure Environment:** The limit for general uncontrolled exposure environment is shown in FCC rule Part 1.1310, Table 1B.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	29 dBi
Coax Loss	2.22 dB
Transmit Frequency	9415.85 MHz
Power Density	1.00 mW/cm ²
Minimum Separation Distance	587.6 cm

2. **General Controlled Exposure Environment:** The limit for controlled exposure environment is shown in FCC rule Part 1.1310, Table 1A.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	29 dBi
Coax Loss	2.22 dB
Maximum Transmit Frequency	9415.85 MHz
Power Density	5.00 mW/cm ²
Minimum Separation Distance	262.8 cm

MPE CALCULATION

Outside Beam (> 10° Horizontal Polarity, > 22° Vertical Polarity)

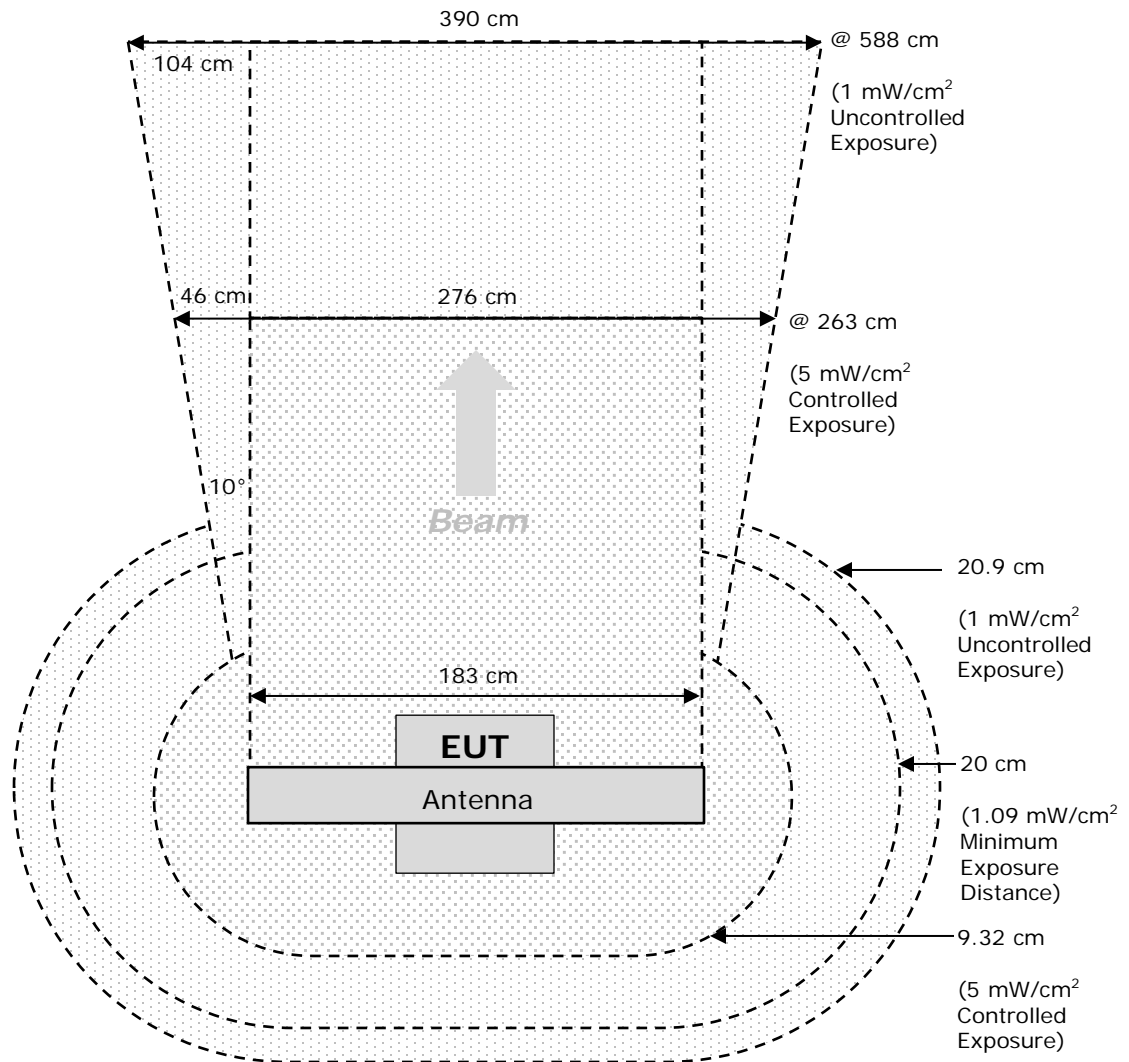
3. **General Uncontrolled Exposure Environment:** The limit for general uncontrolled exposure environment is shown in FCC rule Part 1.1310, Table 1B.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	0 dBi
Coax Loss	2.22 dB
Transmit Frequency	9415.85 MHz
Power Density	1 mW/cm ²
Minimum Separation Distance	20.9 cm

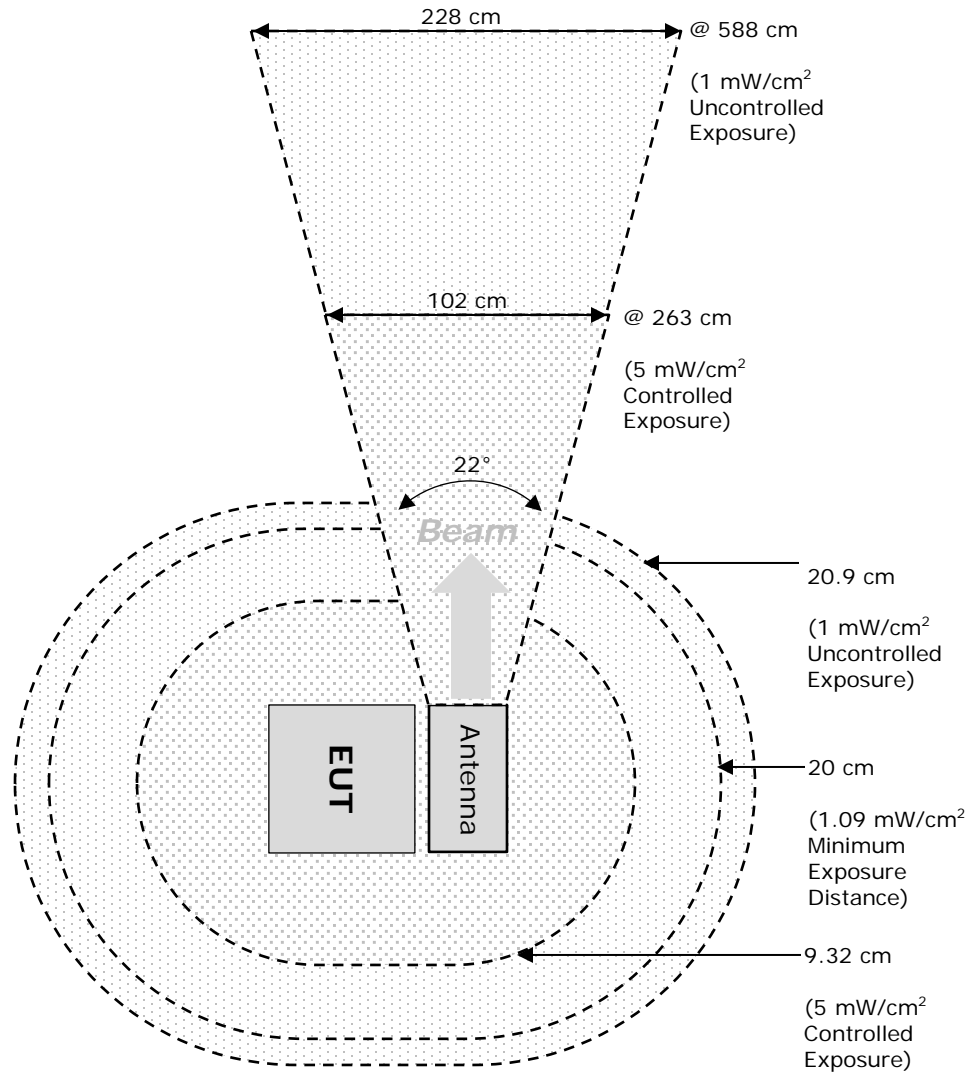
4. **General Controlled Exposure Environment:** The limit for controlled exposure environment is shown in FCC rule Part 1.1310, Table 1A.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	0 dBi
Coax Loss	2.22 dB
Maximum Transmit Frequency	9415.85 MHz
Power Density	1.09 mW/cm ²
Minimum Separation Distance	20 cm

FCC MPE Diagram, 6 ft. X-Band Antenna, Top View



FCC MPE Diagram, 6 ft. X -Band Antenna, Side View



FCC MPE Calculation: 9 ft. X-Band Antenna

Inside Beam (< 0.9° Horizontal Polarity, < 22° Vertical Polarity)

5. **General Uncontrolled Exposure Environment:** The limit for general uncontrolled exposure environment is shown in FCC rule Part 1.1310, Table 1B.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	31 dBi
Coax Loss	2.22 dB
Transmit Frequency	9415.85 MHz
Power Density	1.00 mW/cm ²
Minimum Separation Distance	739.7 cm

6. **General Controlled Exposure Environment:** The limit for controlled exposure environment is shown in FCC rule Part 1.1310, Table 1A.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	31 dBi
Coax Loss	2.22 dB
Maximum Transmit Frequency	9415.85 MHz
Power Density	5.00 mW/cm ²
Minimum Separation Distance	330.8 cm

MPE CALCULATION

Outside Beam (> 10° Horizontal Polarity, > 22° Vertical Polarity)

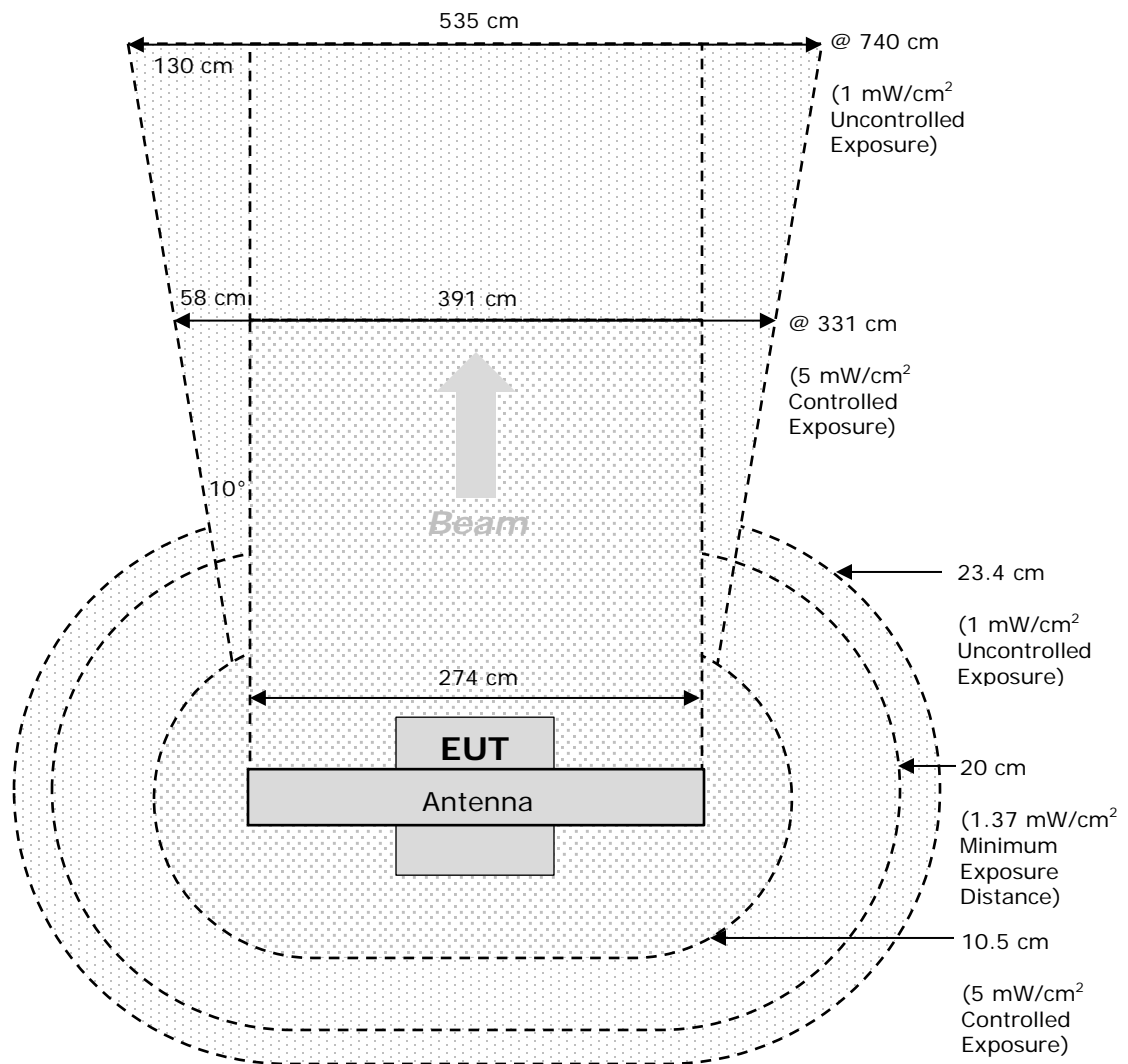
7. **General Uncontrolled Exposure Environment:** The limit for general uncontrolled exposure environment is shown in FCC rule Part 1.1310, Table 1B.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	1 dBi
Coax Loss	2.22 dB
Transmit Frequency	9415.85 MHz
Power Density	1.00 mW/cm ²
Minimum Separation Distance	23.4 cm

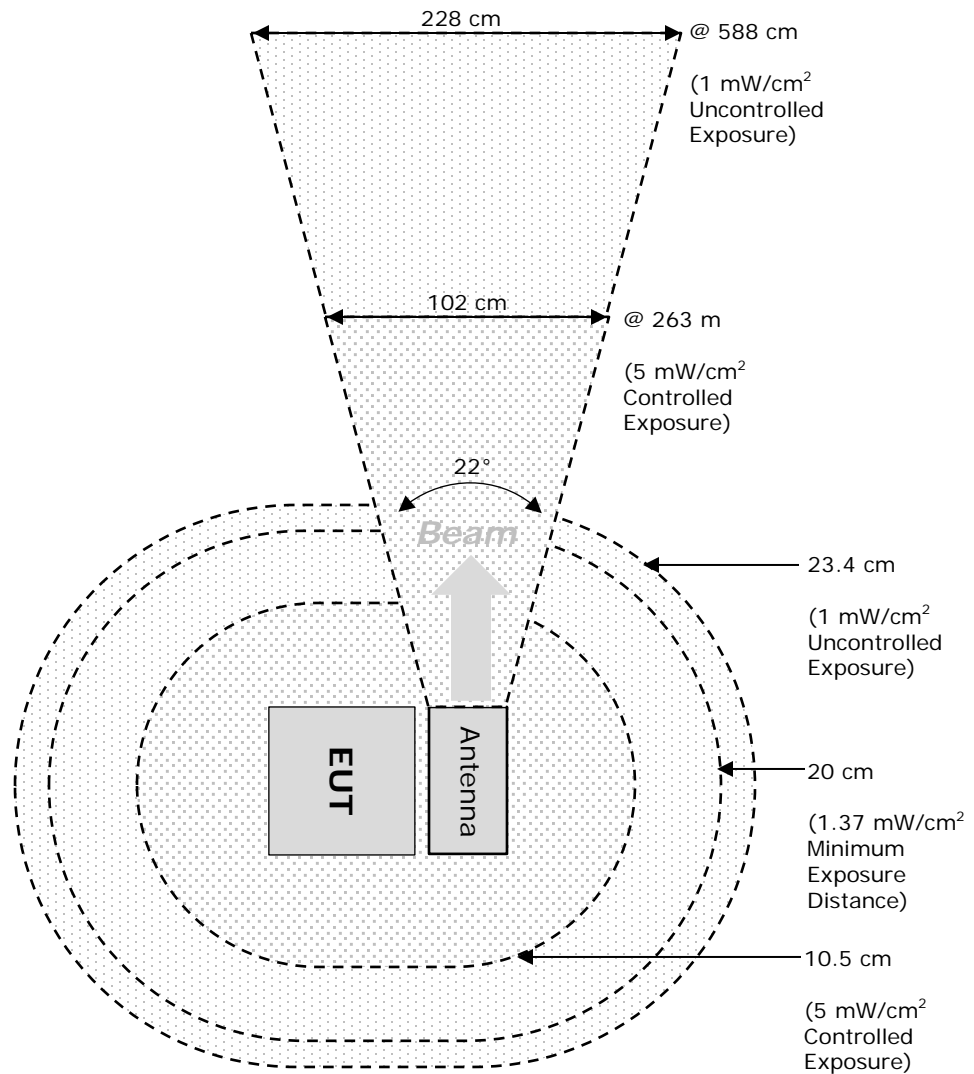
8. **General Controlled Exposure Environment:** The limit for controlled exposure environment is shown in FCC rule Part 1.1310, Table 1A.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	1 dBi
Coax Loss	2.22 dB
Maximum Transmit Frequency	9415.85 MHz
Power Density	1.37 mW/cm ²
Minimum Separation Distance	20 cm

FCC MPE Diagram, 9 ft. X-Band Antenna, Top View



FCC MPE Diagram, 9 ft. X-Band Antenna, Side View



FCC MPE Calculation: 12 ft. X-Band Antenna

Inside Beam ($< 0.7^\circ$ Horizontal Polarity, $< 22^\circ$ Vertical Polarity)

9. **General Uncontrolled Exposure Environment:** The limit for general uncontrolled exposure environment is shown in FCC rule Part 1.1310, Table 1B.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	32.5 dBi
Coax Loss	2.22 dB
Transmit Frequency	9415.85 MHz
Power Density	1.00 mW/cm ²
Minimum Separation Distance	879.1 cm

10. **General Controlled Exposure Environment:** The limit for controlled exposure environment is shown in FCC rule Part 1.1310, Table 1A.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	32.5 dBi
Coax Loss	2.22 dB
Maximum Transmit Frequency	9415.85 MHz
Power Density	5.00 mW/cm ²
Minimum Separation Distance	393.2 cm

MPE CALCULATION

Outside Beam (> 10° Horizontal Polarity, > 22° Vertical Polarity)

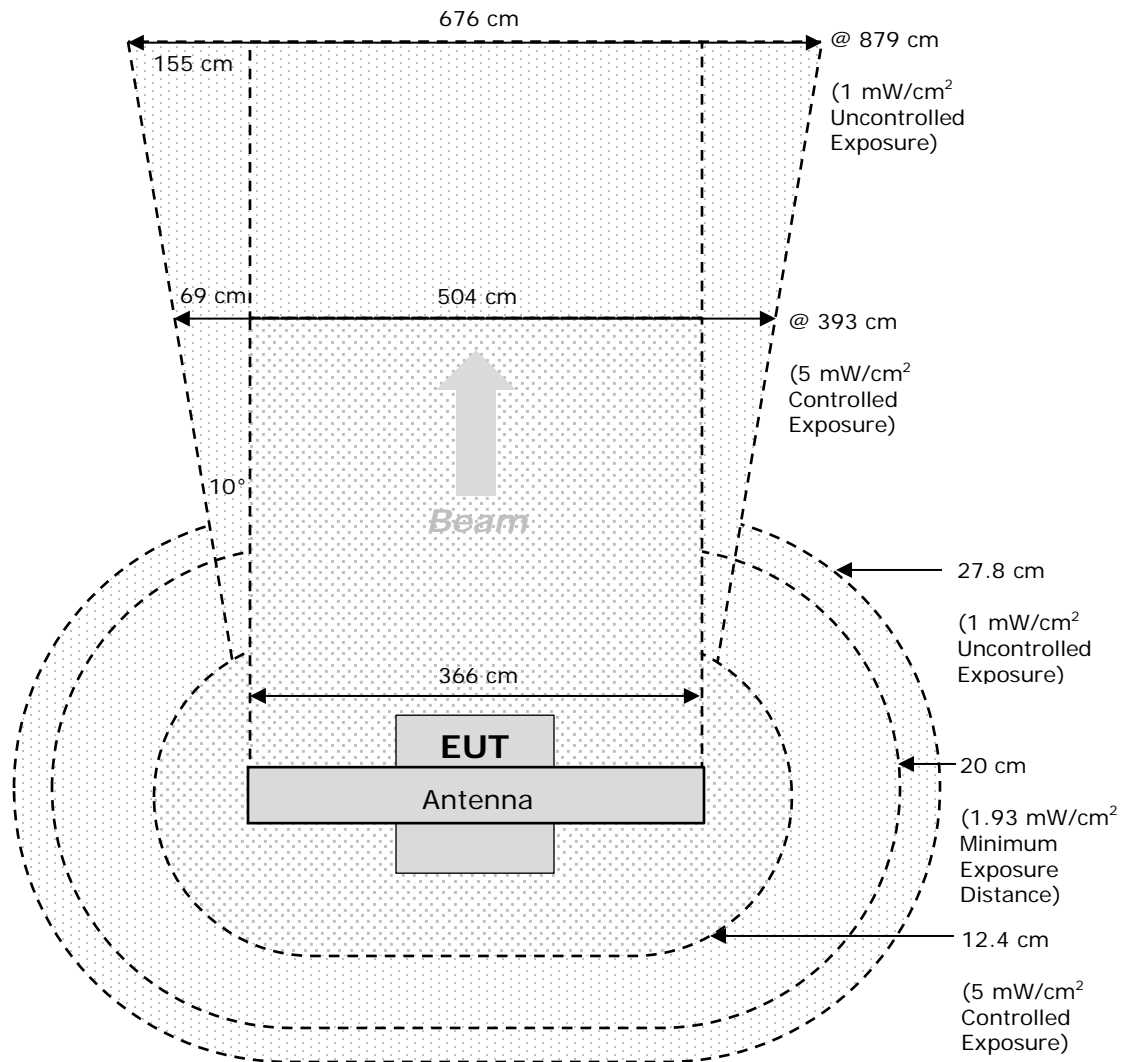
11. **General Uncontrolled Exposure Environment:** The limit for general uncontrolled exposure environment is shown in FCC rule Part 1.1310, Table 1B.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	2.5 dBi
Coax Loss	2.22 dB
Transmit Frequency	9415.85 MHz
Power Density	1.00 mW/cm ²
Minimum Separation Distance	27.8 cm

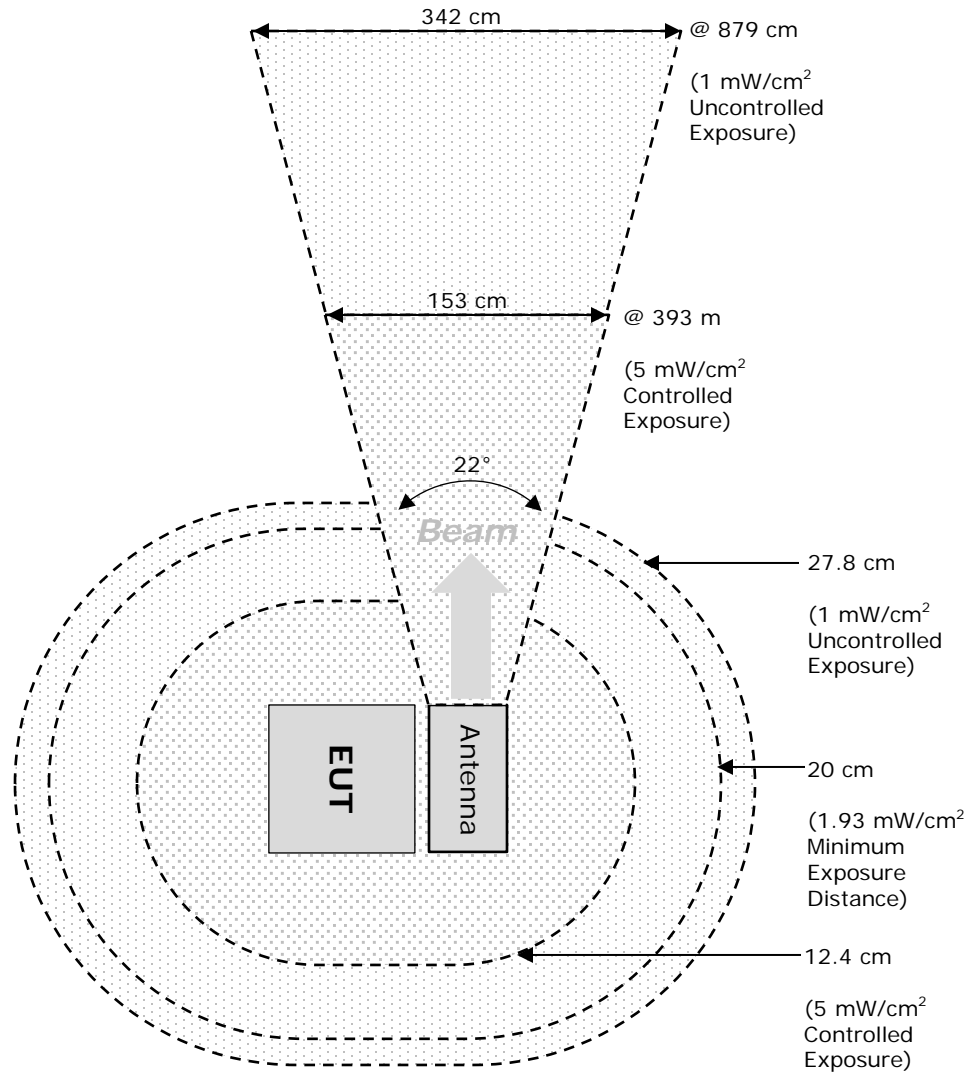
12. **General Controlled Exposure Environment:** The limit for controlled exposure environment is shown in FCC rule Part 1.1310, Table 1A.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	2.5 dBi
Coax Loss	2.22 dB
Maximum Transmit Frequency	9415.85 MHz
Power Density	1.93 mW/cm ²
Minimum Separation Distance	20 cm

FCC MPE Diagram, 12 ft. X-Band Antenna, Top View



FCC MPE Diagram, 12 ft. X-Band Antenna, Side View



IC MPE Calculation: 6 ft. X-Band Antenna

Inside Beam (< 1.3° Horizontal Polarity, < 22° Vertical Polarity)

1. **General Uncontrolled Exposure Environment:** The limit for general uncontrolled exposure environment is shown in RSS-102, Issue 5, Table 4.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	29 dBi
Coax Loss	2.22 dB
Transmit Frequency	9415.85 MHz
Power Density	10.0 W/m ²
Minimum Separation Distance	587.6 cm

2. **General Controlled Exposure Environment:** The limit for controlled exposure environment is shown in RSS-102, Issue 5, Table 6.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	29 dBi
Coax Loss	2.22 dB
Maximum Transmit Frequency	9415.85 MHz
Power Density	50.0 W/m ²
Minimum Separation Distance	262.8 cm

MPE CALCULATION

Outside Beam (> 10° Horizontal Polarity, > 22° Vertical Polarity)

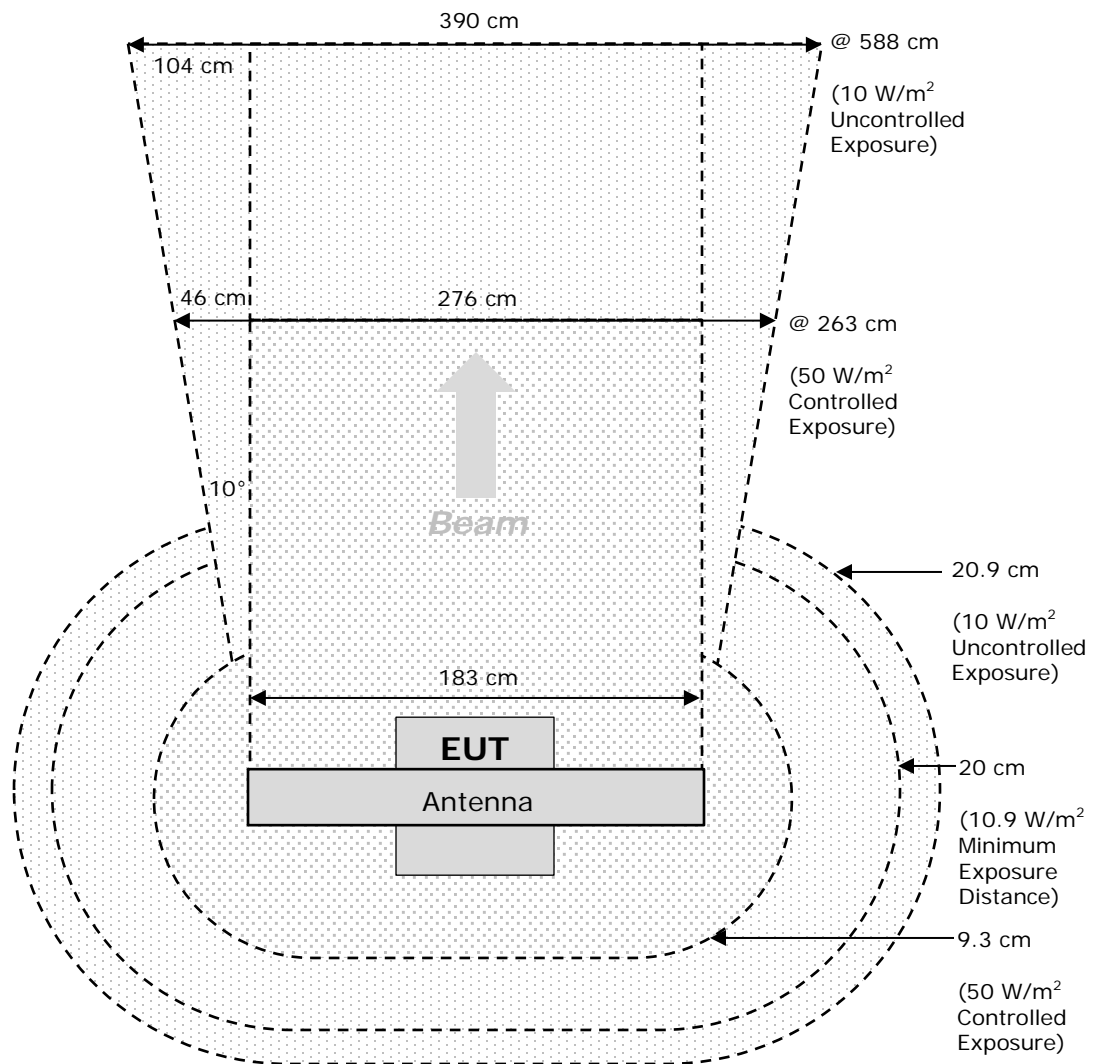
3. **General Uncontrolled Exposure Environment:** The limit for general uncontrolled exposure environment is shown in RSS-102, Issue 5, Table 4.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	0 dBi
Coax Loss	2.22 dB
Transmit Frequency	9415.85 MHz
Power Density	10 W/m ²
Minimum Separation Distance	20.9 cm

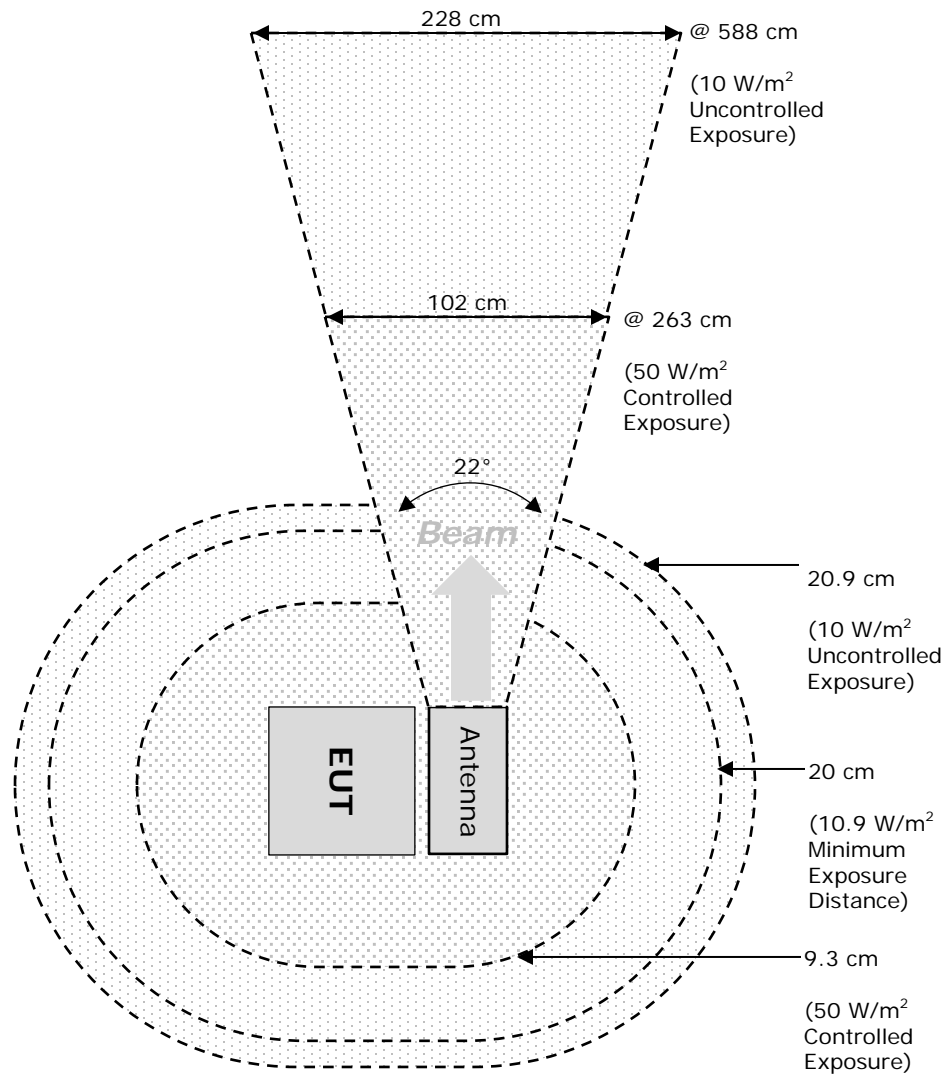
4. **General Controlled Exposure Environment:** The limit for controlled exposure environment is shown in RSS-102, Issue 5, Table 6.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	0 dBi
Coax Loss	2.22 dB
Maximum Transmit Frequency	9415.85 MHz
Power Density	10.87 W/m ²
Minimum Separation Distance	20 cm

IC MPE Diagram, 6 ft. X-Band Antenna, Top View



IC MPE Diagram, 6 ft. X -Band Antenna, Side View



IC MPE Calculation: 9 ft. X-Band Antenna

Inside Beam (< 0.9° Horizontal Polarity, < 22° Vertical Polarity)

5. **General Uncontrolled Exposure Environment:** The limit for general uncontrolled exposure environment is shown in RSS-102, Issue 5, Table 4.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	31 dBi
Coax Loss	2.22 dB
Transmit Frequency	9415.85 MHz
Power Density	10 W/m ²
Minimum Separation Distance	739.7 cm

6. **General Controlled Exposure Environment:** The limit for controlled exposure environment is shown in RSS-102, Issue 5, Table 6.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	31 dBi
Coax Loss	2.22 dB
Maximum Transmit Frequency	9415.85 MHz
Power Density	50 W/m ²
Minimum Separation Distance	330.8 cm

MPE CALCULATION

Outside Beam (> 10° Horizontal Polarity, > 22° Vertical Polarity)

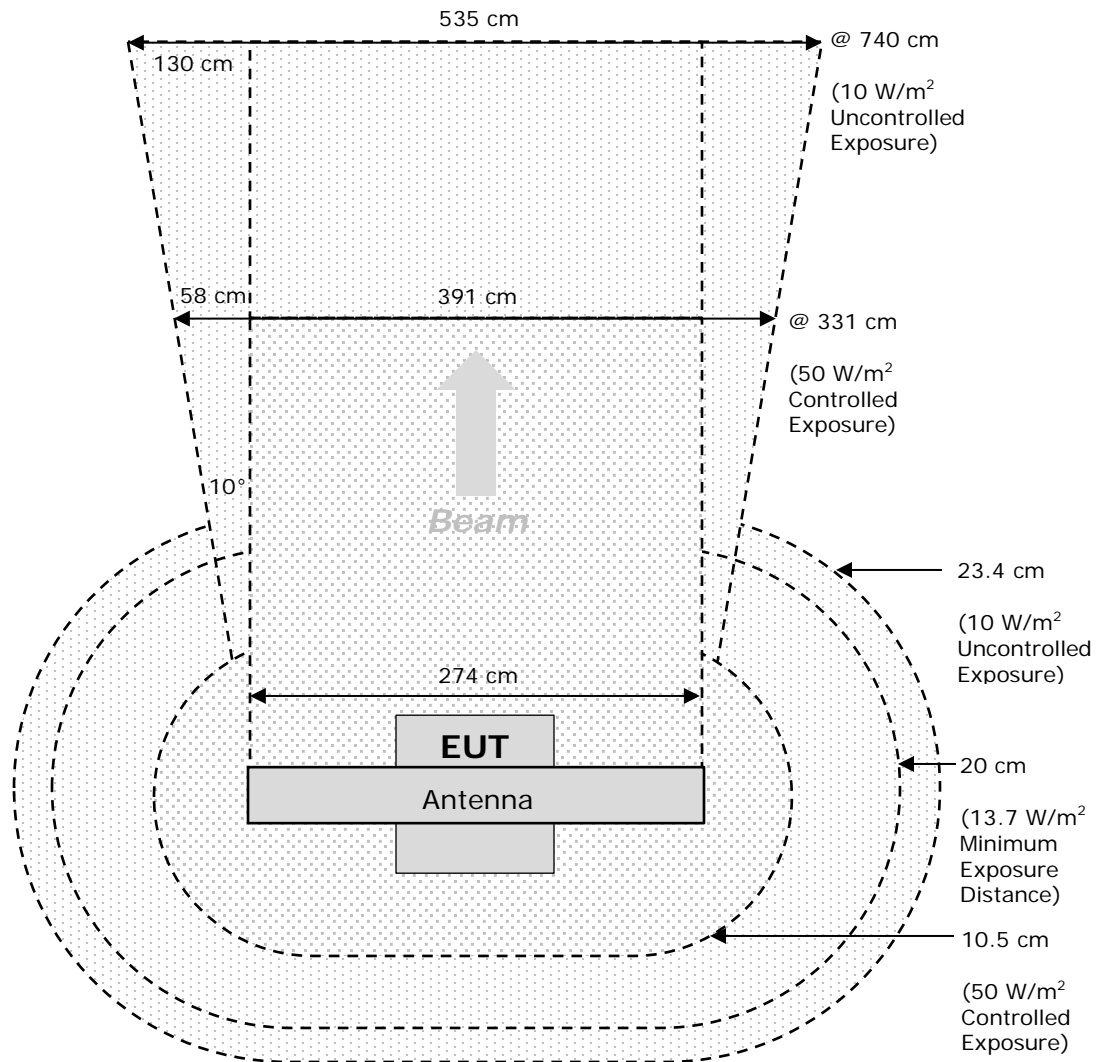
7. **General Uncontrolled Exposure Environment:** The limit for general uncontrolled exposure environment is shown in RSS-102, Issue 5, Table 4.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	1 dBi
Coax Loss	2.22 dB
Transmit Frequency	9415.85 MHz
Power Density	10 W/m ²
Minimum Separation Distance	23.4 cm

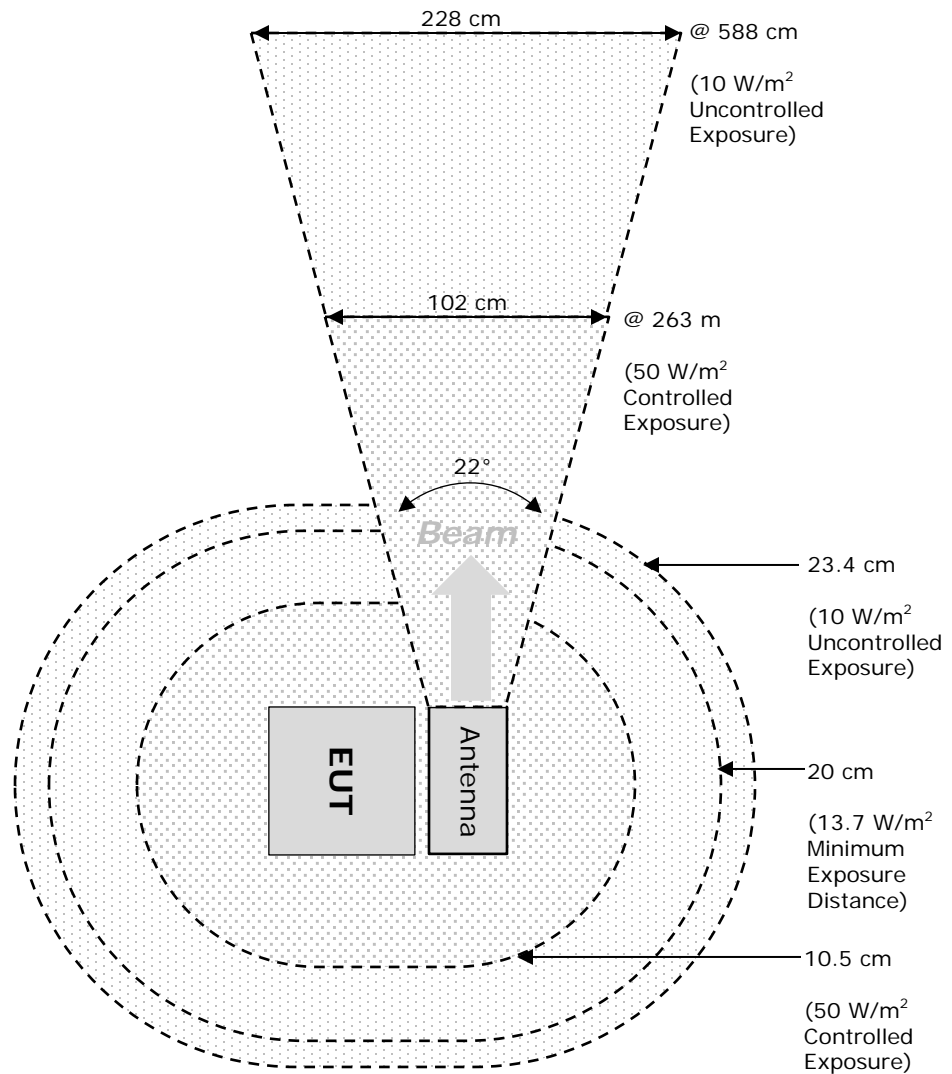
8. **General Controlled Exposure Environment:** The limit for controlled exposure environment is shown in RSS-102, Issue 5, Table 6.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	1 dBi
Coax Loss	2.22 dB
Maximum Transmit Frequency	9415.85 MHz
Power Density	13.7 W/m ²
Minimum Separation Distance	20 cm

IC MPE Diagram, 9 ft. X-Band Antenna, Top View



IC MPE Diagram, 9 ft. X -Band Antenna, Side View



IC MPE Calculation: 12 ft. X-Band Antenna

Inside Beam (< 1.3° Horizontal Polarity, < 22° Vertical Polarity)

9. **General Uncontrolled Exposure Environment:** The limit for general uncontrolled exposure environment is shown in RSS-102, Issue 5, Table 4.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	32.5 dBi
Coax Loss	2.22 dB
Transmit Frequency	9415.85 MHz
Power Density	10 W/m ²
Minimum Separation Distance	879.1 cm

10. **General Controlled Exposure Environment:** The limit for controlled exposure environment is shown in RSS-102, Issue 5, Table 6.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	32.5 dBi
Coax Loss	2.22 dB
Maximum Transmit Frequency	9415.85 MHz
Power Density	50 W/m ²
Minimum Separation Distance	393.2 cm

MPE CALCULATION

Outside Beam (> 10° Horizontal Polarity, > 22° Vertical Polarity)

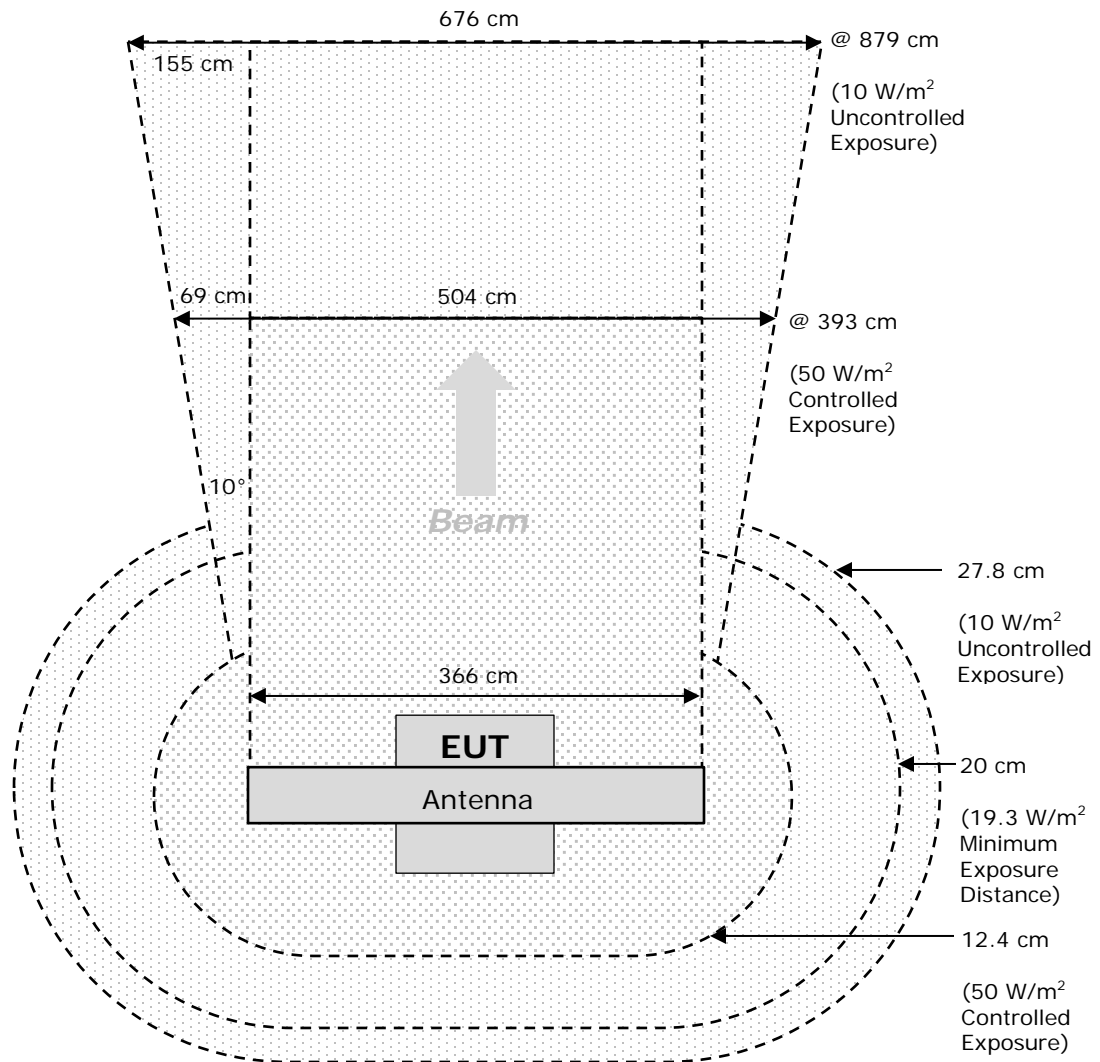
11. **General Uncontrolled Exposure Environment:** The limit for general uncontrolled exposure environment is shown in RSS-102, Issue 5, Table 4.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	2.5 dBi
Coax Loss	2.22 dB
Transmit Frequency	9415.85 MHz
Power Density	10 W/m ²
Minimum Separation Distance	27.8 cm

12. **General Controlled Exposure Environment:** The limit for controlled exposure environment is shown in RSS-102, Issue 5, Table 6.

Variable	Value
Max Power	24609.34 W
Duty Cycle (at full power)	0.037%
Max Antenna Gain	2.5 dBi
Coax Loss	2.22 dB
Maximum Transmit Frequency	9415.85 MHz
Power Density	19.3 W/m ²
Minimum Separation Distance	20 cm

IC MPE Diagram, 12 ft. X-Band Antenna, Top View



IC MPE Diagram, 12 ft. X -Band Antenna, Side View

