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File Number: SES-AMD-INTR2019-04275

FCC APPLICATION FOR SPACE AND EARTH STATION:MOD OR AMD – MAIN FORM	FCC Use Only
FCC 312 MAIN FORM FOR OFFICIAL USE ONLY	

APPLICANT INFORMATION

Enter a description of this application to identify it on the main menu:  
Amendment of E150097 to Add GetSat Terminals

1-8. Legal Name of Applicant			
<b>Name:</b>	ISAT US Inc.	<b>Phone Number:</b>	703-223-3327
<b>DBA Name:</b>		<b>Fax Number:</b>	202-248-5177
<b>Street:</b>	1441 L Street, NW Suite 610	<b>E-Mail:</b>	Brennan.Price@inmarsat.com
<b>City:</b>	Washington	<b>State:</b>	DC
<b>Country:</b>	USA	<b>Zipcode:</b>	20005 -
<b>Attention:</b>	Brennan Price		

9-16. Name of Contact Representative

<b>Name:</b>	Brennan Price	<b>Phone Number:</b>	703-223-3327
<b>Company:</b>	ISAT US Inc.	<b>Fax Number:</b>	202-248-5177
<b>Street:</b>	1441 L St NW Suite 610	<b>E-Mail:</b>	Brennan.Price@inmarsat.com
<b>City:</b>	Washington	<b>State:</b>	DC
<b>Country:</b>	USA	<b>Zipcode:</b>	20005-
<b>Attention:</b>		<b>Relationship:</b>	Same

CLASSIFICATION OF FILING

17. Choose the button next to the classification that applies to this filing for both questions a. and b. Choose only one for 17a and only one for 17b.

- a1. Earth Station
- a2. Space Station

- (N/A) b1. Application for License of New Station
- (N/A) b2. Application for Registration of New Domestic Receive-Only Station
- b3. Amendment to a Pending Application
- b4. Modification of License or Registration
- b5. Assignment of License or Registration
- b6. Transfer of Control of License or Registration
- b7. Notification of Minor Modification
- (N/A) b8. Application for License of New Receive-Only Station Using Non-U.S. Licensed Satellite
- (N/A) b9. Letter of Intent to Use Non-U.S. Licensed Satellite to Provide Service in the United States
- (N/A) b10. Other (Please specify)
- (N/A) b11. Application for Earth Station to Access a Non-U.S. satellite Not Currently Authorized to Provide the Proposed Service in the Proposed Frequencies in the United States
- (N/A) b12. Application for Database Entry
- b13. Amendment to a Pending Database Entry Application
- b14. Modification of Database Entry



**TYPE OF SERVICE**

<p>20. NATURE OF SERVICE: This filing is for an authorization to provide or use the following type(s) of service(s): Select all that apply:</p> <p><input type="checkbox"/> a. Fixed Satellite</p> <p><input checked="" type="checkbox"/> b. Mobile Satellite</p> <p><input type="checkbox"/> c. Radiodetermination Satellite</p> <p><input type="checkbox"/> d. Earth Exploration Satellite</p> <p><input type="checkbox"/> e. Direct to Home Fixed Satellite</p> <p><input type="checkbox"/> f. Digital Audio Radio Service</p> <p><input type="checkbox"/> g. Other (please specify)</p>	
<p>21. STATUS: Choose the button next to the applicable status. Choose only one.</p> <p><input checked="" type="radio"/> Common Carrier      <input checked="" type="radio"/> Non-Common Carrier</p>	<p>22. If earth station applicant, check all that apply.</p> <p><input type="checkbox"/> Using U.S. licensed satellites</p> <p><input checked="" type="checkbox"/> Using Non-U.S. licensed satellites</p>
<p>23. If applicant is providing INTERNATIONAL COMMON CARRIER service, see instructions regarding Sec. 214 filings. Choose one. Are these facilities:</p> <p><input checked="" type="radio"/> Connected to a Public Switched Network      <input checked="" type="radio"/> Not connected to a Public Switched Network      <input checked="" type="radio"/> N/A</p>	
<p>24. FREQUENCY BAND(S): Place an 'X' in the box(es) next to all applicable frequency band(s).</p> <p><input type="checkbox"/> a. C-Band (4/6 GHz)      <input type="checkbox"/> b. Ku-Band (12/14 GHz)</p> <p><input checked="" type="checkbox"/> c. Other (Please specify upper and lower frequencies in MHz.)</p> <p>Frequency Lower: 19700      Frequency Upper: 30000      (Please specify additional frequencies in an attachment)</p>	

## TYPE OF STATION

25. CLASS OF STATION: Choose the button next to the class of station that applies. Choose only one.

- a. Fixed Earth Station
- b. Temporary–Fixed Earth Station
- c. 12/14 GHz VSAT Network
- d. Mobile Earth Station
- e. Geostationary Space Station
- f. Non–Geostationary Space Station
- g. Other (please specify)      Earth station on fixed/moving platforms

26. TYPE OF EARTH STATION FACILITY:

- Transmit/Receive     Transmit–Only     Receive–Only     N/A

"For Space Station applications, select N/A."

## PURPOSE OF MODIFICATION

27. The purpose of this proposed modification is to: (Place an 'X' in the box(es) next to all that apply.)

- a -- authorization to add new emission designator and related service
- b -- authorization to change emission designator and related service
- c -- authorization to increase EIRP and EIRP density
- d -- authorization to replace antenna
- e -- authorization to add antenna
- f -- authorization to relocate fixed station
- g -- authorization to change frequency(ies)
- h -- authorization to add frequency
- i -- authorization to add Points of Communication (satellites & countries)
- j -- authorization to change Points of Communication (satellites & countries)
- k -- authorization for facilities for which environmental assessment and radiation hazard reporting is required
- l -- authorization to change orbit location
- m -- authorization to perform fleet management
- n -- authorization to extend milestones
- o -- Other (Please specify)

ENVIRONMENTAL POLICY

<p>28. Would a Commission grant of any proposal in this application or amendment have a significant environmental impact as defined by 47 CFR 1.1307? If YES, submit the statement as required by Sections 1.1308 and 1.1311 of the Commission’s rules, 47 C.F.R. 1.1308 and 1.1311, as an exhibit to this application. A Radiation Hazard Study must accompany all applications for new transmitting facilities, major modifications, or major amendments.</p>	<p><input type="radio"/> Yes <input checked="" type="radio"/> No</p> <p>Rad Haz Analysis</p>
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ALIEN OWNERSHIP Earth station applicants not proposing to provide broadcast, common carrier, aeronautical en route or aeronautical fixed radio station services are not required to respond to Items 30–34.

<p>29. Is the applicant a foreign government or the representative of any foreign government?</p>	<p><input type="radio"/> Yes <input checked="" type="radio"/> No</p>
<p>30. Is the applicant an alien or the representative of an alien?</p>	<p><input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> N/A</p>
<p>31. Is the applicant a corporation organized under the laws of any foreign government?</p>	<p><input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> N/A</p>
<p>32. Is the applicant a corporation of which more than one–fifth of the capital stock is owned of record or voted by aliens or their representatives or by a foreign government or representative thereof or by any corporation organized under the laws of a foreign country?</p>	<p><input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> N/A</p>

33. Is the applicant a corporation directly or indirectly controlled by any other corporation of which more than one-fourth of the capital stock is owned of record or voted by aliens, their representatives, or by a foreign government or representative thereof or by any corporation organized under the laws of a foreign country?

Yes  No  N/A

34. If any answer to questions 29, 30, 31, 32 and/or 33 is Yes, attach as an exhibit an identification of the aliens or foreign entities, their nationality, their relationship to the applicant, and the percentage of stock they own or vote.

#### BASIC QUALIFICATIONS

35. Does the Applicant request any waivers or exemptions from any of the Commission's Rules?  
If Yes, attach as an exhibit, copies of the requests for waivers or exceptions with supporting documents.

Yes  No

36. Has the applicant or any party to this application or amendment had any FCC station authorization or license revoked or had any application for an initial, modification or renewal of FCC station authorization, license, or construction permit denied by the Commission? If Yes, attach as an exhibit, an explanation of circumstances.

Yes  No



37. Has the applicant, or any party to this application or amendment, or any party directly or indirectly controlling the applicant ever been convicted of a felony by any state or federal court? If Yes, attach as an exhibit, an explanation of circumstances.

Yes  No

38. Has any court finally adjudged the applicant, or any person directly or indirectly controlling the applicant, guilty of unlawfully monopolizing or attempting unlawfully to monopolize radio communication, directly or indirectly, through control of manufacture or sale of radio apparatus, exclusive traffic arrangement or any other means or unfair methods of competition? If Yes, attach as an exhibit, an explanation of circumstances

Yes  No

39. Is the applicant, or any person directly or indirectly controlling the applicant, currently a party in any pending matter referred to in the preceding two items? If yes, attach as an exhibit, an explanation of the circumstances.

Yes  No

40. If the applicant is a corporation and is applying for a space station license, attach as an exhibit the names, address, and citizenship of those stockholders owning a record and/or voting 10 percent or more of the Filer's voting stock and the percentages so held. In the case of fiduciary control, indicate the beneficiary(ies) or class of beneficiaries. Also list the names and addresses of the officers and directors of the Filer.

41. By checking Yes, the undersigned certifies, that neither applicant nor any other party to the application is subject to a denial of Federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Act of 1988, 21 U.S.C. Section 862, because of a conviction for possession or distribution of a controlled substance. See 47 CFR 1.2002(b) for the meaning of "party to the application" for these purposes.

Yes  No

42a. Does the applicant intend to use a non-U.S. licensed satellite to provide service in the United States? If Yes, answer 42b and attach an exhibit providing the information specified in 47 C.F.R. 25.137, as appropriate. If No, proceed to question 43.

Yes  No

42b. What administration has licensed or is in the process of licensing the space station? If no license will be issued, what administration has coordinated or is in the process of coordinating the space station?United Kingdom

43. Description. (Summarize the nature of the application and the services to be provided). (If the complete description does not appear in this box, please go to the end of the form to view it in its entirety.)

ISAT US seeks to modify its blanket earth station license, Call Sign E150097 to add Get Sat Earth station terminal types that will communicate with the Inmarsat-5 F2 and Inmarsat-5 F3 satellites.

Narrative

43a. Geographic Service Rule Certification

By selecting A, the undersigned certifies that the applicant is not subject to the geographic service or geographic coverage requirements specified in 47 C.F.R. Part 25.

A

By selecting B, the undersigned certifies that the applicant is subject to the geographic service or geographic coverage requirements specified in 47 C.F.R. Part 25 and will comply with such requirements.

B

By selecting C, the undersigned certifies that the applicant is subject to the geographic service or geographic coverage requirements specified in 47 C.F.R. Part 25 and will not comply with such requirements because it is not feasible as a technical matter to do so, or that, while technically feasible, such services would require so many compromises in satellite design and operation as to make it economically unreasonable. A narrative description and technical analysis demonstrating this claim are attached.

C

**CERTIFICATION**

The Applicant waives any claim to the use of any particular frequency or of the electromagnetic spectrum as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise, and requests an authorization in accordance with this application. The applicant certifies that grant of this application would not cause the applicant to be in violation of the spectrum aggregation limit in 47 CFR Part 20. All statements made in exhibits are a material part hereof and are incorporated herein as if set out in full in this application. The undersigned, individually and for the applicant, hereby certifies that all statements made in this application and in all attached exhibits are true, complete and correct to the best of his or her knowledge and belief, and are made in good faith.

44. Applicant is a (an): (Choose the button next to applicable response.)

- Individual
- Unincorporated Association
- Partnership
- Corporation
- Governmental Entity
- Other (please specify)

45. Name of Person Signing  
Brennan Price

46. Title of Person Signing  
Director, Regulatory Affairs

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WILLFUL FALSE STATEMENTS MADE ON THIS FORM ARE PUNISHABLE BY FINE AND / OR IMPRISONMENT  
(U.S. Code, Title 18, Section 1001), AND/OR REVOCATION OF ANY STATION AUTHORIZATION  
(U.S. Code, Title 47, Section 312(a)(1)), AND/OR FORFEITURE (U.S. Code, Title 47, Section 503).

SATELLITE EARTH STATION AUTHORIZATIONS  
 FCC Form 312 – Schedule B:(Technical and Operational Description)  
 FOR OFFICIAL USE ONLY

Location of Earth Station Site

E1. Site Identifier:	19	E5. Call Sign:	E150097
E2. Contact Name	Ananda Mishra	E6. Phone Number:	808-638-5820
E3. Street:	58-350 Kamehameha Hwy	E7. City:	Haleiwa
		E8. County:	Honolulu
E4. State	HI	E9. Zip Code	96712
E10. Area of Operation:	CONUS, Puerto Rico, USVI, Alaska, Hawaii, US Territories		
E11. Latitude:	0 °0 '0.0 "		
E12. Longitude:	0 °0 '0.0 "		
E13. Lat/Lon Coordinates are:	<input type="radio"/> NAD-27	<input type="radio"/> NAD-83	<input checked="" type="radio"/> N/A
E14. Site Elevation (AMSL):	0.0 meters		

E15. If the proposed antenna(s) operate in the Fixed Satellite Service (FSS) with geostationary satellites, do(es) the proposed antenna(s) comply with the antenna gain patterns specified in Section 25.209(a) and (b) as demonstrated by the manufacturer's qualification measurement? If NO, provide as a technical analysis showing compliance with two-degree spacing policy.

Yes     No     N/A

E16. If the proposed antenna(s) do not operate in the Fixed Satellite Service (FSS), or if they operate in the Fixed Satellite Service (FSS) with non-geostationary satellites, do(es) the proposed antenna(s) comply with the antenna gain patterns specified in Section 25.209(a2) and (b) as demonstrated by the manufacturer's qualification measurements?	<input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> N/A
E17. Is the facility operated by remote control? If YES, provide the location and telephone number of the control point.	<input checked="" type="radio"/> Yes <input type="radio"/> No

E18. Is frequency coordination required? If YES, attach a frequency coordination report as	<input type="radio"/> Yes <input checked="" type="radio"/> No
E19. Is coordination with another country required? If YES, attach the name of the country(ies) and plot of coordination contours as	<input type="radio"/> Yes <input checked="" type="radio"/> No
<p>E20. FAA Notification – (See 47 CFR Part 17 and 47 CFR part 25.113(c)) Where FAA notification is required, have you attached a copy of a completed FCC Form 854 and/or the FAA's study regarding the potential hazard of the structure to aviation?</p> <p><b>FAILURE TO COMPLY WITH 47 CFR PARTS 17 AND 25 WILL RESULT IN THE RETURN OF THIS APPLICATION.</b></p>	<input type="radio"/> Yes <input checked="" type="radio"/> No

**POINTS OF COMMUNICATION**

Satellite Name: INMARSAT 5F3   INMARSAT 5F3   179.6 E.L.    If you selected OTHER, please enter the following:	
E21. Common Name:	E22. ITU Name:
E23. Orbit Location:	E24. Country:

Satellite Name: INMARSAT 5F2   INMARSAT 5F2   55.0 W.L.    If you selected OTHER, please enter the following:
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E21. Common Name:	E22. ITU Name:
E23. Orbit Location:	E24. Country:

**POINTS OF COMMUNICATION (Destination Points)**

E25. Site Identifier:	
E26. Common Name:	E27. Country:

**ANTENNA**

Site ID	E28. Antenna Id	E29. Quantity	E30. Manufacturer	E31. Model	E32. Antenna Size<meters>	E41/42. Antenna Gain Transmint and/or Recieve (____ dBi at _____ GHz)	
19	MilliSat-W	50	GetSat	MilliSat-W	0.5	35.4 dBi at 30	
19	MilliSat-W	50	GetSat	MilliSat-W	0.5	35.2 dBi at 29.5	
19	MilliSat-W	50	GetSat	MilliSat-W	0.5	38.3 dBi at 19.7	
19	MilliSat-W	50	GetSat	MilliSat-W	0.5	38.6 dBi at 20.2	

E28. Antenna Id	E33/34. Diameter Minor/Major (meters)	E35. Above Ground Level (meters)	E36. Above Sea Level(meters)	E37. Building Height Above Ground Level (meters)	E38. Total Input Power at antenna flange (Watts)	E39. Maximum Antenna Height Above Rooftop (meters)	E40. Total EIRP for al carriers(dBW)
MilliSat-W	0.135/0.5	0.0	0.0	0.0	16.0	0.0	48.8

**FREQUENCY**

E28. Antenna Id	E43/44. Frequency Bands (MHz)	E45. T/R Mode	E46. Antenna Polarization(H,V, L,R)	E47. Emission Designator	E48. Maximum EIRP per Carrier (dBW)	E49. Maximum ERIP Density per Carrier (dBW/4kHz)
MilliSat-W	19700 20200	R	Left Hand Circular	32M0G7W	0.0	0.0
<p>E50. Modulation and Services (If the complete description does not appear in this box, please go to the end of the form to view it in its entirety.)</p> <div data-bbox="254 521 1854 695" style="border: 1px solid black; padding: 5px;"> <p>Various modulations up to 32 APSK Digital Data Link</p> </div>						
MilliSat-W	29500 30000	T	Right Hand Circular	460KG7W	48.8	28.2
<p>E50. Modulation and Services (If the complete description does not appear in this box, please go to the end of the form to view it in its entirety.)</p> <div data-bbox="254 911 1854 1084" style="border: 1px solid black; padding: 5px;"> <p>Various modulations up to 32 APSK Digital Data Link</p> </div>						
MilliSat-W	29500 30000	T	Right Hand Circular	5M00G1W	48.8	17.8



E50. Modulation and Services (If the complete description does not appear in this box, please go to the end of the form to view it in its entirety.)

Various modulations up to 32 APSK Digital Data Link

**FREQUENCY COORDINATION**

<b>E28. Antenna Id</b>	<b>E51. Satellite Orbit Type</b>	<b>E52/53. Frequency Limits(MHz)</b>	<b>E54/55. Range of Satellite Arc Eastern/Western Limit</b>	<b>E56. Earth Station Azimuth Angle Eastern Limit</b>	<b>E57. Antenna Elevation Angle Eastern Limit</b>	<b>E58. Earth Station Azimuth Angle Western Limit</b>	<b>E59. Antenna Elevation Angle Western Limit</b>	<b>E60. Maximum EIRP Density toward the Horizon (dBW/4kHz)</b>
MilliSat-W	Geostationary	19700 20200	0.0/360.0	0.0	5.0	0.0	5.0	0.0
	Geostationary	29500 30000	0.0/360.0	0.0	5.0	0.0	5.0	-9.0

**REMOTE CONTROL POINT LOCATION**

E61. Call Sign E120072 NOTE: Please enter the callsign of the controlling station, not the callsign for which this application is being filed.		E66. Phone Number 808-638-5820	
E62. Street Address 6211 Glen Circle (MilliSat-W)			
E63. City Lino Lakes		E68. County Anoka	
		E67/68. State/Country MN/ USA	E64. Zip Code 55014

SATELLITE EARTH STATION AUTHORIZATIONS  
FCC Form 312 – Schedule B:(Technical and Operational Description)  
FOR OFFICIAL USE ONLY

Location of Earth Station Site

E1. Site Identifier:	20	E5. Call Sign:	E140029
E2. Contact Name	Ananda Mishra	E6. Phone Number:	808-638-5820
E3. Street:	58-350 Kamehameha Hwy	E7. City:	Haleiwa
		E8. County:	Honolulu
E4. State	HI	E9. Zip Code	96712
E10. Area of Operation:	CONUS, Puerto Rico, USVI, Alaska, Hawaii, US Territories		
E11. Latitude:	0 °0 '0.0 "		
E12. Longitude:	0 °0 '0.0 "		
E13. Lat/Lon Coordinates are:	<input type="radio"/> NAD-27	<input type="radio"/> NAD-83	<input checked="" type="radio"/> N/A
E14. Site Elevation (AMSL):	0.0 meters		

E15. If the proposed antenna(s) operate in the Fixed Satellite Service (FSS) with geostationary satellites, do(es) the proposed antenna(s) comply with the antenna gain patterns specified in Section 25.209(a) and (b) as demonstrated by the manufacturer's qualification measurement? If NO, provide as a technical analysis showing compliance with two-degree spacing policy.

Yes    No    N/A

E16. If the proposed antenna(s) do not operate in the Fixed Satellite Service (FSS), or if they operate in the Fixed Satellite Service (FSS) with non-geostationary satellites, do(es) the proposed antenna(s) comply with the antenna gain patterns specified in Section 25.209(a2) and (b) as demonstrated by the manufacturer's qualification measurements?	<input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> N/A
E17. Is the facility operated by remote control? If YES, provide the location and telephone number of the control point.	<input checked="" type="radio"/> Yes <input type="radio"/> No

E18. Is frequency coordination required? If YES, attach a frequency coordination report as	<input type="radio"/> Yes <input checked="" type="radio"/> No
E19. Is coordination with another country required? If YES, attach the name of the country(ies) and plot of coordination contours as	<input type="radio"/> Yes <input checked="" type="radio"/> No
<p>E20. FAA Notification – (See 47 CFR Part 17 and 47 CFR part 25.113(c)) Where FAA notification is required, have you attached a copy of a completed FCC Form 854 and/or the FAA's study regarding the potential hazard of the structure to aviation?</p> <p><b>FAILURE TO COMPLY WITH 47 CFR PARTS 17 AND 25 WILL RESULT IN THE RETURN OF THIS APPLICATION.</b></p>	<input type="radio"/> Yes <input checked="" type="radio"/> No

**POINTS OF COMMUNICATION**

Satellite Name: INMARSAT 5F3   INMARSAT 5F3   179.6 E.L.    If you selected OTHER, please enter the following:	
E21. Common Name:	E22. ITU Name:
E23. Orbit Location:	E24. Country:

Satellite Name: INMARSAT 5F2   INMARSAT 5F2   55.0 W.L.    If you selected OTHER, please enter the following:
---

E21. Common Name:	E22. ITU Name:
E23. Orbit Location:	E24. Country:

**POINTS OF COMMUNICATION (Destination Points)**

E25. Site Identifier:	
E26. Common Name:	E27. Country:

**ANTENNA**

Site ID	E28. Antenna Id	E29. Quantity	E30. Manufacturer	E31. Model	E32. Antenna Size<meters>	E41/42. Antenna Gain Transmint and/or Recieve (____ dBi at _____ GHz)	
20	MilliSat-H	50	GetSat	MilliSat-H	0.27	32.9 dBi at 29.5	
20	MilliSat-H	50	GetSat	MilliSat-H	0.27	33.8 dBi at 20.2	
20	MilliSat-H	50	GetSat	MilliSat-H	0.27	33.9 dBi at 19.7	
20	MilliSat-H	50	GetSat	MilliSat-H	0.27	34.3 dBi at 30.0	

E28. Antenna Id	E33/34. Diameter Minor/Major (meters)	E35. Above Ground Level (meters)	E36. Above Sea Level(meters)	E37. Building Height Above Ground Level (meters)	E38. Total Input Power at antenna flange (Watts)	E39. Maximum Antenna Height Above Rooftop (meters)	E40. Total EIRP for al carriers(dBW)
MilliSat-H	0.248/0.27	0.0	0.0	0.0	16.0	0.0	48.8

**FREQUENCY**

E28. Antenna Id	E43/44. Frequency Bands (MHz)	E45. T/R Mode	E46. Antenna Polarization(H,V, L,R)	E47. Emission Designator	E48. Maximum EIRP per Carrier (dBW)	E49. Maximum ERIP Density per Carrier (dBW/4kHz)
MilliSat-H	19700 20200	R	Left Hand Circular	32M0G7W	0.0	0.0
E50. Modulation and Services (If the complete description does not appear in this box, please go to the end of the form to view it in its entirety.) <div data-bbox="254 521 1856 695" style="border: 1px solid black; padding: 5px;">             Various modulations up to 32 APSK Digital Data Link           </div>						
MilliSat-H	29500 30000	T	Right Hand Circular	460KG7W	48.8	28.2
E50. Modulation and Services (If the complete description does not appear in this box, please go to the end of the form to view it in its entirety.) <div data-bbox="254 911 1856 1084" style="border: 1px solid black; padding: 5px;">             Various modulations up to 32 APSK Digital Data Link           </div>						
MilliSat-H	29500 30000	T	Right Hand Circular	5M00G1W	48.8	17.8

E50. Modulation and Services (If the complete description does not appear in this box, please go to the end of the form to view it in its entirety.)

Various modulations up to 32 APSK Digital Data Link

**FREQUENCY COORDINATION**

<b>E28. Antenna Id</b>	<b>E51. Satellite Orbit Type</b>	<b>E52/53. Frequency Limits(MHz)</b>	<b>E54/55. Range of Satellite Arc Eastern/Western Limit</b>	<b>E56. Earth Station Azimuth Angle Eastern Limit</b>	<b>E57. Antenna Elevation Angle Eastern Limit</b>	<b>E58. Earth Station Azimuth Angle Western Limit</b>	<b>E59. Antenna Elevation Angle Western Limit</b>	<b>E60. Maximum EIRP Density toward the Horizon (dBW/4kHz)</b>
MilliSat-H	Geostationary	19700 20200	0.0/360.0	0.0	5.0	0.0	5.0	0.0
	Geostationary	29500 30000	0.0/360.0	0.0	5.0	0.0	5.0	-9.0

**REMOTE CONTROL POINT LOCATION**

E61. Call Sign E120072 NOTE: Please enter the callsign of the controlling station, not the callsign for which this application is being filed.		E66. Phone Number 808-638-5820	
E62. Street Address 6211 Glen Circle (MilliSat-H)			
E63. City Lino Lakes		E68. County Anoka	
		E67/68. State/Country MN/ USA	E64. Zip Code 55014

SATELLITE EARTH STATION AUTHORIZATIONS  
FCC Form 312 – Schedule B:(Technical and Operational Description)  
FOR OFFICIAL USE ONLY

Location of Earth Station Site

E1. Site Identifier: 21                      E5. Call Sign: E150097  
E2. Contact Name Ananda Mishra      E6. Phone Number: 808–638–5820  
E3. Street: 58–350 Kamehameha Hwy      E7. City: Haleiwa  
E8. County: Honolulu  
E4. State HI                      E9. Zip Code 96712  
E10. Area of Operation: CONUS, Puerto Rico, USVI, Alaska, Hawaii, US Territories  
E11. Latitude: 0 °0 '0.0 "  
E12. Longitude: 0 °0 '0.0 "  
E13. Lat/Lon Coordinates are:       NAD–27       NAD–83       N/A  
E14. Site Elevation (AMSL): 0.0 meters

E15. If the proposed antenna(s) operate in the Fixed Satellite Service (FSS) with geostationary satellites, do(es) the proposed antenna(s) comply with the antenna gain patterns specified in Section 25.209(a) and (b) as demonstrated by the manufacturer’s qualification measurement? If NO, provide as a technical analysis showing compliance with two-degree spacing policy.

Yes     No     N/A

E16. If the proposed antenna(s) do not operate in the Fixed Satellite Service (FSS), or if they operate in the Fixed Satellite Service (FSS) with non-geostationary satellites, do(es) the proposed antenna(s) comply with the antenna gain patterns specified in Section 25.209(a2) and (b) as demonstrated by the manufacturer's qualification measurements?	<input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> N/A
E17. Is the facility operated by remote control? If YES, provide the location and telephone number of the control point.	<input checked="" type="radio"/> Yes <input type="radio"/> No

E18. Is frequency coordination required? If YES, attach a frequency coordination report as	<input type="radio"/> Yes <input checked="" type="radio"/> No
E19. Is coordination with another country required? If YES, attach the name of the country(ies) and plot of coordination contours as	<input type="radio"/> Yes <input checked="" type="radio"/> No
<p>E20. FAA Notification – (See 47 CFR Part 17 and 47 CFR part 25.113(c)) Where FAA notification is required, have you attached a copy of a completed FCC Form 854 and/or the FAA's study regarding the potential hazard of the structure to aviation?</p> <p><b>FAILURE TO COMPLY WITH 47 CFR PARTS 17 AND 25 WILL RESULT IN THE RETURN OF THIS APPLICATION.</b></p>	<input type="radio"/> Yes <input checked="" type="radio"/> No

**POINTS OF COMMUNICATION**

Satellite Name: INMARSAT 5F3   INMARSAT 5F3   179.6 E.L.    If you selected OTHER, please enter the following:	
E21. Common Name:	E22. ITU Name:
E23. Orbit Location:	E24. Country:

Satellite Name: INMARSAT 5F2   INMARSAT 5F2   55.0 W.L.    If you selected OTHER, please enter the following:
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E21. Common Name:	E22. ITU Name:
E23. Orbit Location:	E24. Country:

**POINTS OF COMMUNICATION (Destination Points)**

E25. Site Identifier:	
E26. Common Name:	E27. Country:

**ANTENNA**

Site ID	E28. Antenna Id	E29. Quantity	E30. Manufacturer	E31. Model	E32. Antenna Size<meters>	E41/42. Antenna Gain Transmint and/or Recieve (____ dBi at _____ GHz)	
21	MicroSat	50	GetSat	MicroSat	0.248	31.5 dBi at 20.2	
21	MicroSat	50	GetSat	MicroSat	0.248	31.75 dBi at 30.0	
21	MicroSat	50	GetSat	MicroSat	0.248	32.2 dBi at 29.5	
21	MicroSat	50	GetSat	MicroSat	0.248	33.7 dBi at 19.7	

E28. Antenna Id	E33/34. Diameter Minor/Major (meters)	E35. Above Ground Level (meters)	E36. Above Sea Level(meters)	E37. Building Height Above Ground Level (meters)	E38. Total Input Power at antenna flange (Watts)	E39. Maximum Antenna Height Above Rooftop (meters)	E40. Total EIRP for al carriers(dBW)
MicroSat	0.135/0.248	0.0	0.0	0.0	16.0	0.0	46.0

**FREQUENCY**

E28. Antenna Id	E43/44. Frequency Bands (MHz)	E45. T/R Mode	E46. Antenna Polarization(H,V, L,R)	E47. Emission Designator	E48. Maximum EIRP per Carrier (dBW)	E49. Maximum ERIP Density per Carrier (dBW/4kHz)
MicroSat	19700 20200	R	Left Hand Circular	32M0G7W	0.0	0.0
E50. Modulation and Services (If the complete description does not appear in this box, please go to the end of the form to view it in its entirety.) <div data-bbox="254 521 1856 695" style="border: 1px solid black; padding: 5px;">             Various modulations up to 32 APSK Digital Data Link           </div>						
MicroSat	29500 30000	T	Right Hand Circular	460KG7W	46.0	25.4
E50. Modulation and Services (If the complete description does not appear in this box, please go to the end of the form to view it in its entirety.) <div data-bbox="254 911 1856 1084" style="border: 1px solid black; padding: 5px;">             Various modulations up to 32 APSK Digital Data Link           </div>						
MicroSat	29500 30000	T	Right Hand Circular	5M00G1W	46.0	15.0

E50. Modulation and Services (If the complete description does not appear in this box, please go to the end of the form to view it in its entirety.)

Various modulations up to 32 APSK Digital Data Link

**FREQUENCY COORDINATION**

<b>E28. Antenna Id</b>	<b>E51. Satellite Orbit Type</b>	<b>E52/53. Frequency Limits(MHz)</b>	<b>E54/55. Range of Satellite Arc Eastern/Western Limit</b>	<b>E56. Earth Station Azimuth Angle Eastern Limit</b>	<b>E57. Antenna Elevation Angle Eastern Limit</b>	<b>E58. Earth Station Azimuth Angle Western Limit</b>	<b>E59. Antenna Elevation Angle Western Limit</b>	<b>E60. Maximum EIRP Density toward the Horizon (dBW/4kHz)</b>
MicroSat	Geostationary	19700 20200	0.0/360.0	0.0	5.0	0.0	5.0	0.0
	Geostationary	29500 30000	0.0/360.0	0.0	5.0	0.0	5.0	-9.0

**REMOTE CONTROL POINT LOCATION**

E61. Call Sign E120072 NOTE: Please enter the callsign of the controlling station, not the callsign for which this application is being filed.		E66. Phone Number 808-638-5820	
E62. Street Address 6211 Glen Circle (MicroSat)			
E63. City Lino Lakes		E68. County Anoka	
		E67/68. State/Country MN/ USA	E64. Zip Code 55014

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**ISAT US Inc.**  
**FCC Form 312 Exhibit A**

**Application to Amend Pending Application to Modify License E150097**

**I. DESCRIPTION OF MODIFICATION**

ISAT US Inc. (hereinafter “ISAT US”) hereby seeks to amend its pending application to modify its Global Xpress blanket license for Ka-band land-based terminals, Call Sign E150097 (“License”). The License initially was issued under IBFS File No. SES-LIC-20150625-00383 (“GX Land Application”) and was modified by File Nos. SES-MFS-20160527-00458, SES-MOD-20160720-00669, SES-MOD-20170425-00465, SES-MOD-20180323-00263, and SES-MOD-20190417-00528. The License is now the subject of a currently-pending modification application, SES-MOD-20190801-01017, to add two new Panther II terminals. This amendment will add three new GX Earth Station in Motion (“ESIM”) terminal types (“MicroSat”, “MilliSat-W”, “MilliSat-H”) that will communicate with the Inmarsat-5 F2 (“I5F2”) and Inmarsat-5 F3 (“I5F3”) satellites. These same three terminals were the subject of a previous application to modify Inmarsat’s maritime ESIM license, Call Sign E140029, which was granted by the FCC on May 2, 2019.<sup>1</sup> The technical characteristics of the terminals are unchanged from the earlier application; the present application seeks authorization of these terminals for land-based ESIM use.

Section II addresses the proposed new Earth station terminals. ISAT US incorporates by reference Exhibit F (response to Question E17 regarding the remote control point at Inmarsat’s Lino Lakes MN gateway, as the gateway complies with the recently adopted shut-off capabilities under Section 25.228(c)), updates Exhibit G (24-hour point of contact)<sup>2</sup> of the GX Land

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<sup>1</sup> See IBFS File No. SES-MOD-20190321-00390.

<sup>2</sup> The 24-hour point of contact with the ability to shut down any of the terminals immediately upon notification of harmful interference is at Inmarsat’s Lino Lakes Gateway, call sign E120072.

Application, and it incorporates by reference certain other portions of the GX Land Application, as referenced below.

## **II. NEW EARTH STATION IN MOTION TERMINALS**

This application seeks to add three terminal models that are manufactured by GetSat. The terminals will provide mobile communications services over Inmarsat's Ka-band Global Xpress satellite system in the 29.5-30.0 GHz (Earth-to-space) and 19.7-20.2 GHz (space-to-Earth) frequency bands. The License currently covers operations in the 29.5-30.0 GHz (Earth-to-space) and 19.7-20.2 GHz (space-to-Earth) frequency bands. This application seeks authority to operate in these same frequencies for land-based mobile applications. As pictured below, the GetSat terminals utilize small flat panel antennas to achieve a compact terminal size that is especially useful in mobile applications. These terminals will add to the option of terminals available to meet the needs of land-based users and allow professional personnel from organizations from various sectors, initially U.S. government and potentially including in the future media and humanitarian, to quickly deploy mobile communications capability to meet mission needs.

### **A. Land-Based ESIM Terminal Description**

This application seeks to license the MicroSat, Millisat-W, and Millisat-H terminals manufactured by GetSat ("GetSat Terminals"). The terminals will operate on the same frequencies as the GX Terminals in the current License: 29.5-30.0 GHz (Earth-to-space) and 19.7-20.2 GHz (space-to-Earth). As illustrated in the off-axis EIRP spectral density plots in Exhibit B, the MicroSat, Millisat-W, and Millisat-H terminals meet the EIRP density performance requirements in Section 25.218(i) under clear sky conditions. Additionally, each

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The new contact person is Ananda Mishra, available at 808 638-5820. This updated information is reflected in Form 312 Questions E61-E66.

of these ESIM terminal types will successfully receive signals from the I5F2 and I5F3 satellites below the maximum permitted power flux density at the Earth's surface of -118 dBW/m<sup>2</sup>/MHz. Thus, the proposed terminals are able to operate without causing unacceptable interference, consistent with the requirements of Section 25.209(f).<sup>3</sup>

The Commission has deleted the requirement to provide receive earth station patterns in the 19.7-20.2 GHz frequency band (see Sections 25.132 and 25.115). To the extent that the proposed terminal may have minor exceedance at certain off-axis angles, ISAT US agrees to accept interference from adjacent FSS satellite networks to the extent the relevant receiving antenna performance requirements of Section 25.209 are exceeded.

Radiation hazard analyses for the MicroSat, Millisat-W, and Millisat-H terminals and a discussion of the results are provided in Exhibit C.

The proposed GetSat Terminals will be subject to the same national security requirements described in Section 4 of Exhibit A of the GX Land Application. That discussion is incorporated by reference herein. Inmarsat has completed US334 coordination for the I5F2 and I5F3 satellites with the applicable Federal users. Each of the GetSat terminals complies with Sections 25.228(b) (self-monitoring) and 25.228(c) (network control and monitoring center). The terminals self-monitor and detect when there is a loss in the corresponding receive link. Upon detection of such loss of link, the terminal will immediately cease transmissions. This regulatory function is tested on each individual terminal during its first Over-the-Air Test. Additionally, each individual terminal can be monitored and controlled through a "Hub" at Inmarsat's Lino Lakes Gateway. The network will not allow the terminal

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<sup>3</sup> See Section 25.209(f).

to transmit should the terminal violate any of the PSD or EIRP limits for the terminal; the Hub is aware of the terminal limitations as per terminal type, and the terminal will only transmit on those assigned slots/carriers the Hub instructs each terminal to use.

The following sections provide a description of each of the terminal types.

## **B. MICROSAT Terminal**

The required technical data for the proposed MicroSat earth station is provided in the Form 312. This terminal type employs a 0.248 x 0.135 meter flat panel antenna and the half-power beamwidth required to be stated by Section 25.115(a)(9) is 2.4 degrees. In addition, for blanket licensing of transmitting Earth stations in the 29.5-30.0 GHz band, the Commission adopted off-axis EIRP spectral density levels contained in Section 25.218(i). As illustrated in the off-axis EIRP spectral density plots in Exhibit B, the proposed terminal type meets the performance requirements in Section 25.218(i) under clear sky conditions.

Below are images of the MicroSat terminal both inside and outside of its radome:







### C. MILLISAT-W Terminal

The required technical data for the proposed MILLISAT-W earth station is provided in the Form 312. This terminal type utilizes a variation on the MicroSat design, that employs a 0.5 x 0.135 meter flat panel antenna; and the half-power beamwidth required to be stated by Section 25.115(a)(9) is 1.2 degrees. In addition, for blanket licensing of transmitting Earth stations in the 29.5-30.0 GHz band, the Commission adopted off-axis EIRP spectral density levels contained in Section 25.218(i). As illustrated in the off-axis EIRP spectral density plots in Exhibit B, the proposed terminal type meets the performance requirements in Section 25.218(i) under clear sky conditions.

Below are images of the MilliSat-W terminal, both inside and outside of its radome:





#### **D. MILLISAT-H Terminal**

The required technical data for the proposed MILLISAT-H earth station is provided in the Form 312. This terminal type utilizes a variation on the MicroSat design, that employs a 0.248 x 0.27 meter flat panel antenna; and the half-power beamwidth required to be stated by Section 25.115(a)(9) is 2.2 degrees. In addition, for blanket licensing of transmitting Earth stations in the 29.5-30.0 GHz band, the Commission adopted off-axis EIRP spectral density levels contained in c Section 25.218(i). As illustrated in the off-axis EIRP spectral density plots in Exhibit B, the proposed terminal type meets the performance requirements in Section 25.218(i). under clear sky conditions.

Below is an image of the MilliSat-H terminal both inside and outside of its radome:



### **III. REQUEST FOR WAIVER**

ISAT US hereby respectfully requests a partial waiver of Sections 25.115(g) and 25.132(b)(1) of the FCC's rules to the extent the antenna plots in Exhibit B of this application do not cover the entire range of off-axis angles called for in those rule sections. The relevant portions of Sections 25.115 and 25.132 call for plots of maximum co-polarized EIRP density in the plane tangent to the GSO arc at off-axis angles from minus 180° to plus 180°. Exhibit

B of this application includes plots covering off-axis angles from minus 90° to plus 90°.

These are the plots that were provided by the terminal manufacturer, and ISAT US was unable to receive plots covering the rest of the range called for in Sections 25.115 and 25.132 of the FCC's rules.<sup>4</sup> The plots provided for each antenna show a sharp drop off in EIRP density at angles moving away from the GSO arc, and in each case show that by minus 50° or plus 50°, the EIRP densities are well below the envelope specified in Section 25.209 of the FCC's rules. This strong performance against the Section 25.209 envelope is in part a result of the small rectangular panel and tight beam-forming of the GetSat terminal antennas. As a result of the terminal design, there is no reason to expect that that the EIRP density levels would dramatically increase beyond minus 90° or plus 90°. Grant of this partial waiver will help accelerate the approval process of these terminals by not requiring unnecessary and duplicative measurements to be taken by the manufacturer, and thus would serve the public interest.

#### **IV. RESPONSE TO QUESTION 36**

ISAT US submits this response to Question 36 of the FCC Form 312 out of an abundance of caution. In 2005, the Commission dismissed a Petition for Declaratory Ruling (the "Petition") filed by Inmarsat Mobile Networks, Inc.'s affiliate, Inmarsat Global Limited ("Inmarsat Global"), seeking United States market access to provide MSS in the 2 GHz band. Subsequent to Inmarsat Global's filing, the Commission assigned all 2 GHz spectrum currently allocated for

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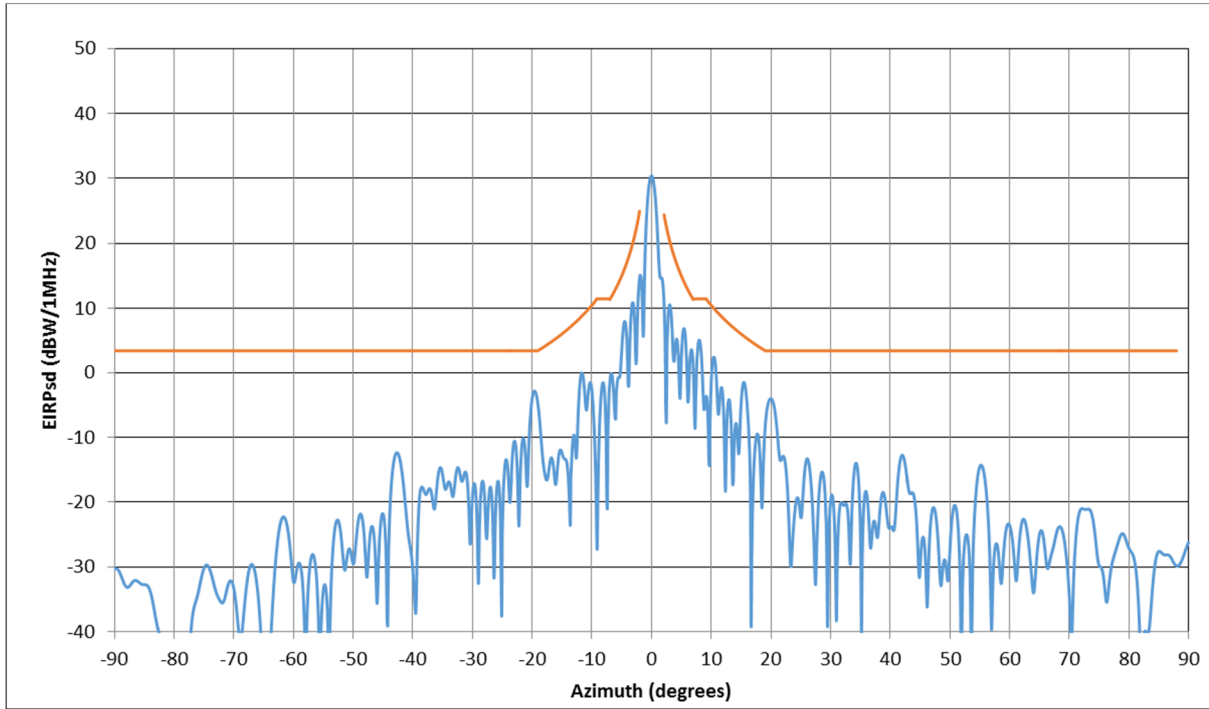
<sup>4</sup> In other instances, the plots provided by the manufacturer show greater ranges than those required under the FCC rules. Those greater ranges are included in this application for completeness and only reinforce the favorable performance of the GetSat terminals.

MSS in the United States to two other satellite operators, and thus dismissed Inmarsat Global's Petition.

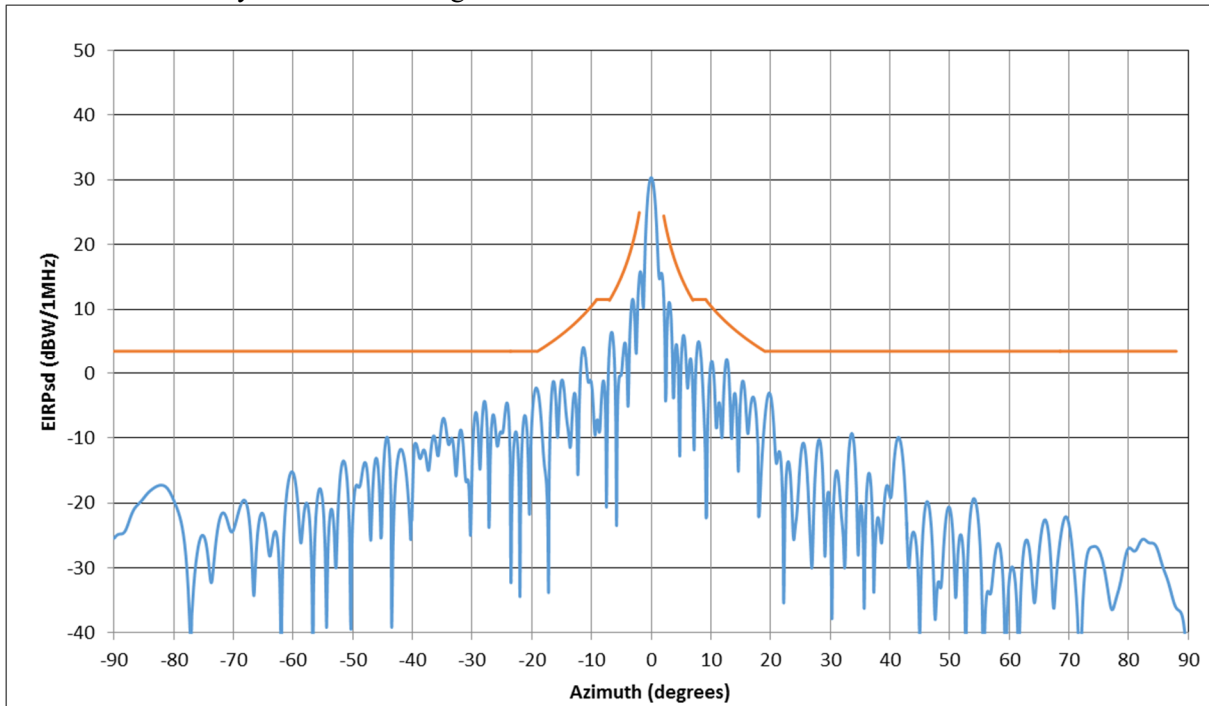
# EXHIBIT B

## 1.0 MilliSat-W Off-Axis EIRP Masks

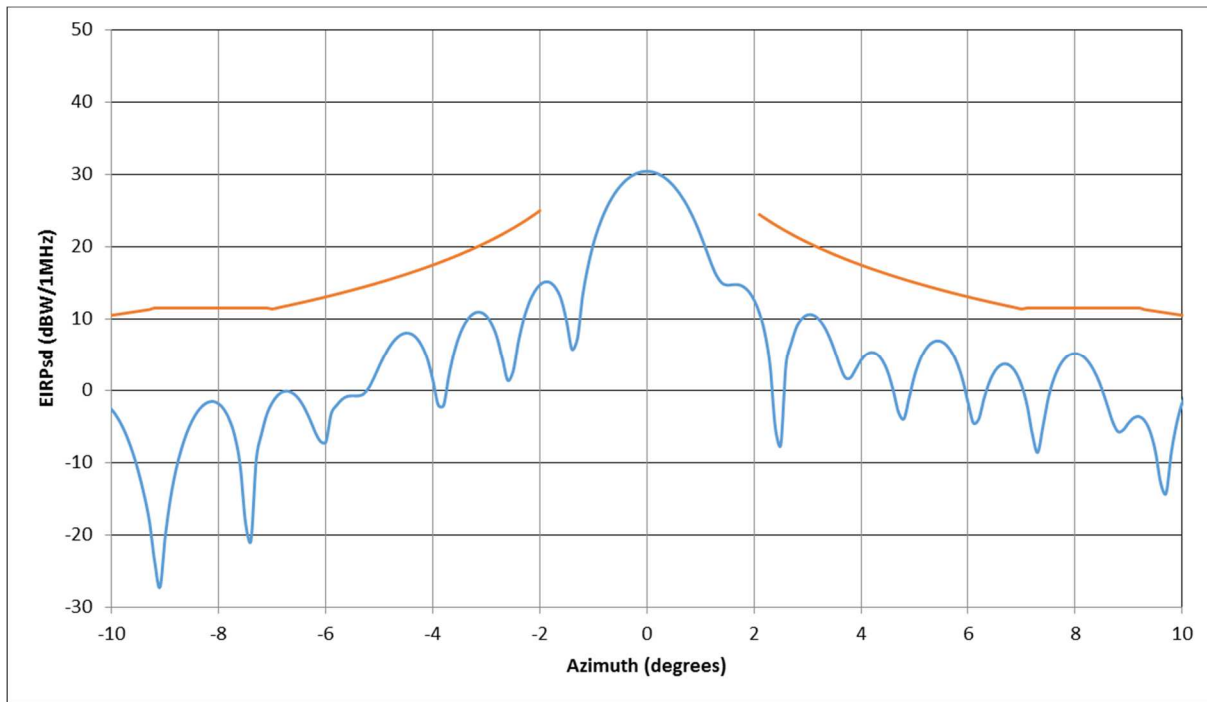
Co-Pol EIRP density in the Plane Tangent to the GSO Arc 29.5 GHz



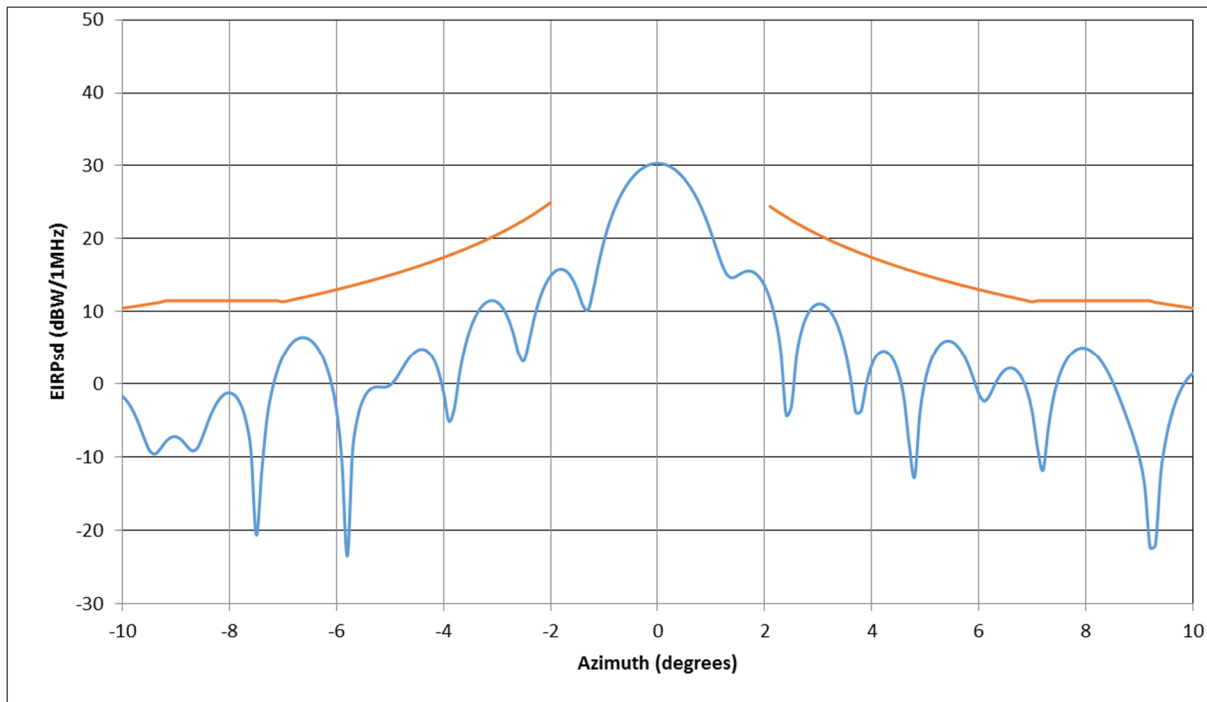
Co-Pol EIRP density in the Plane Tangent to the GSO Arc 30.0 GHz



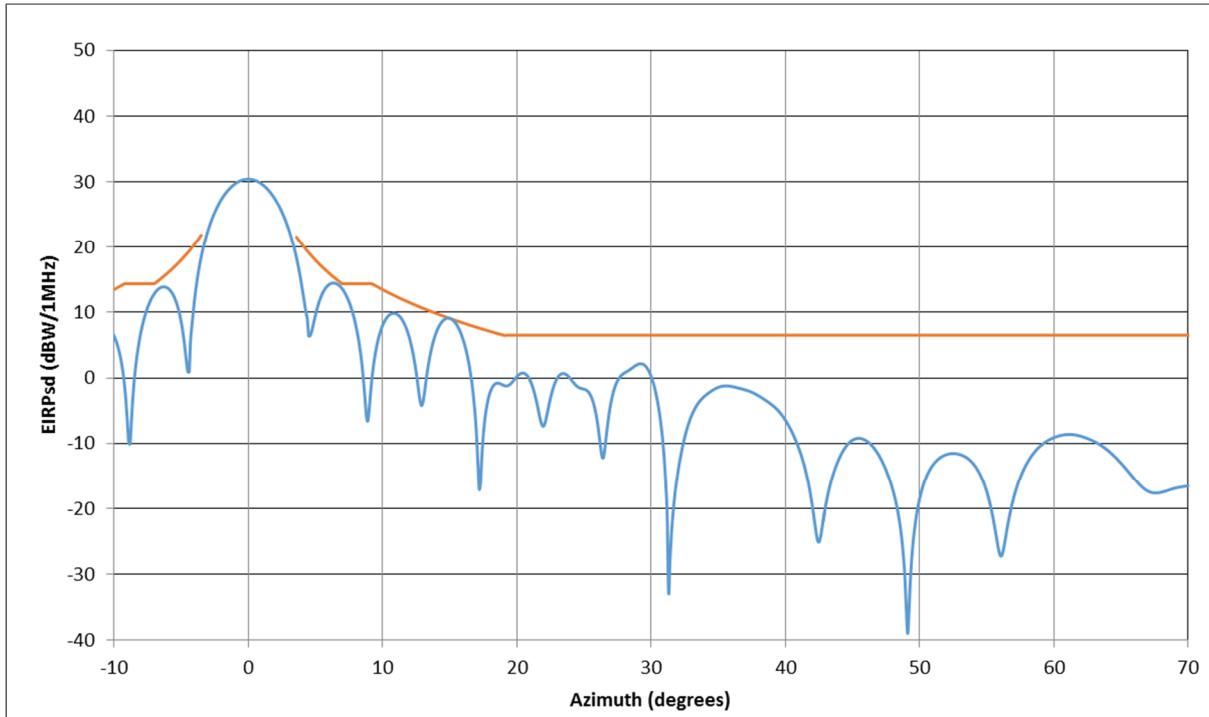
Co-Pol EIRP density in the Plane Tangent to the GSO Arc 29.5 GHz (-10 to +10 degrees)



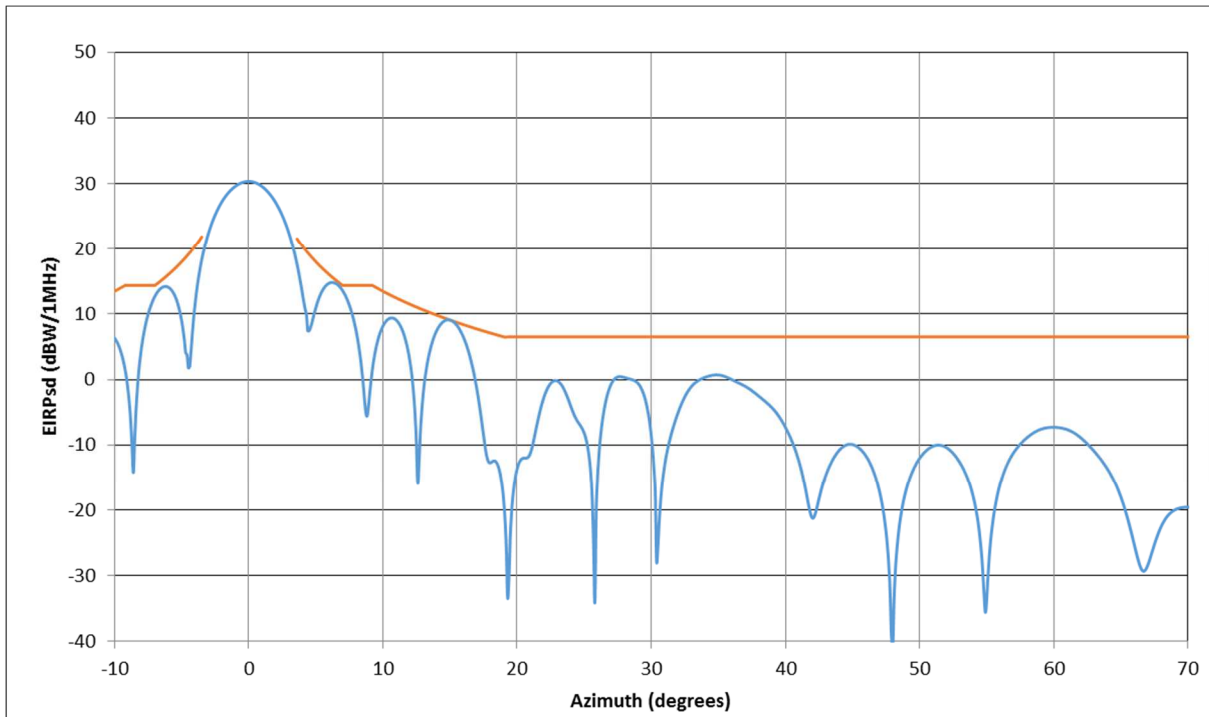
Co-Pol EIRP density in the Plane Tangent to the GSO Arc 30.0 GHz (-10 to +10 degrees)



Co-Pol EIRP density in the Perpendicular to the GSO Arc 29.5 GHz (0 to +30 degrees)

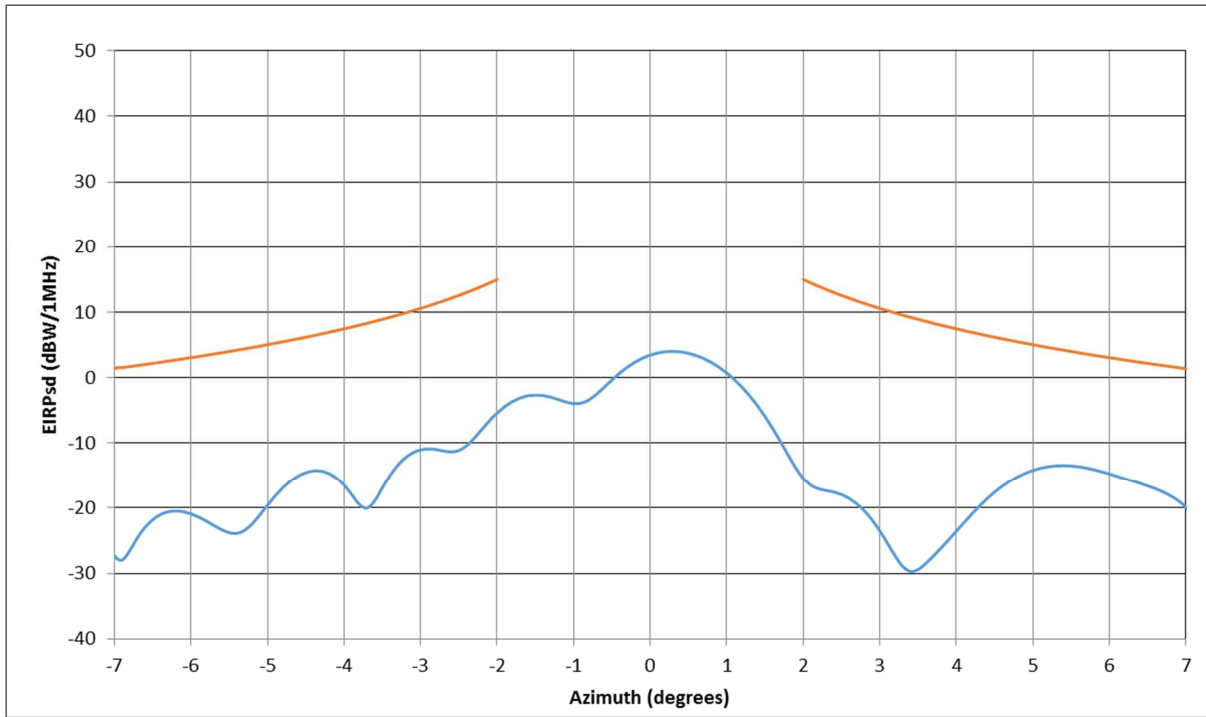


Co-Pol EIRP density in the Perpendicular to the GSO Arc 30.0 GHz (0 to +30 degrees)

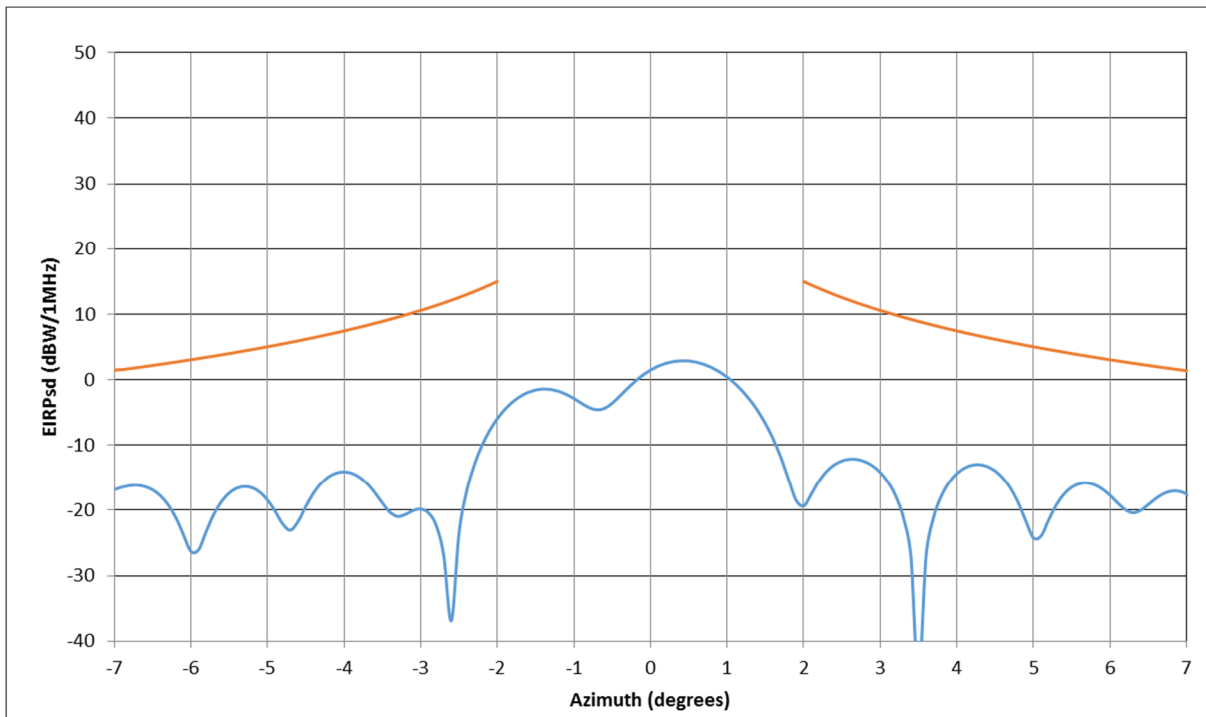


X-Pol EIRP density in the plane tangent to the GSO Arc 29.5 GHz (-7 to +7 degrees)

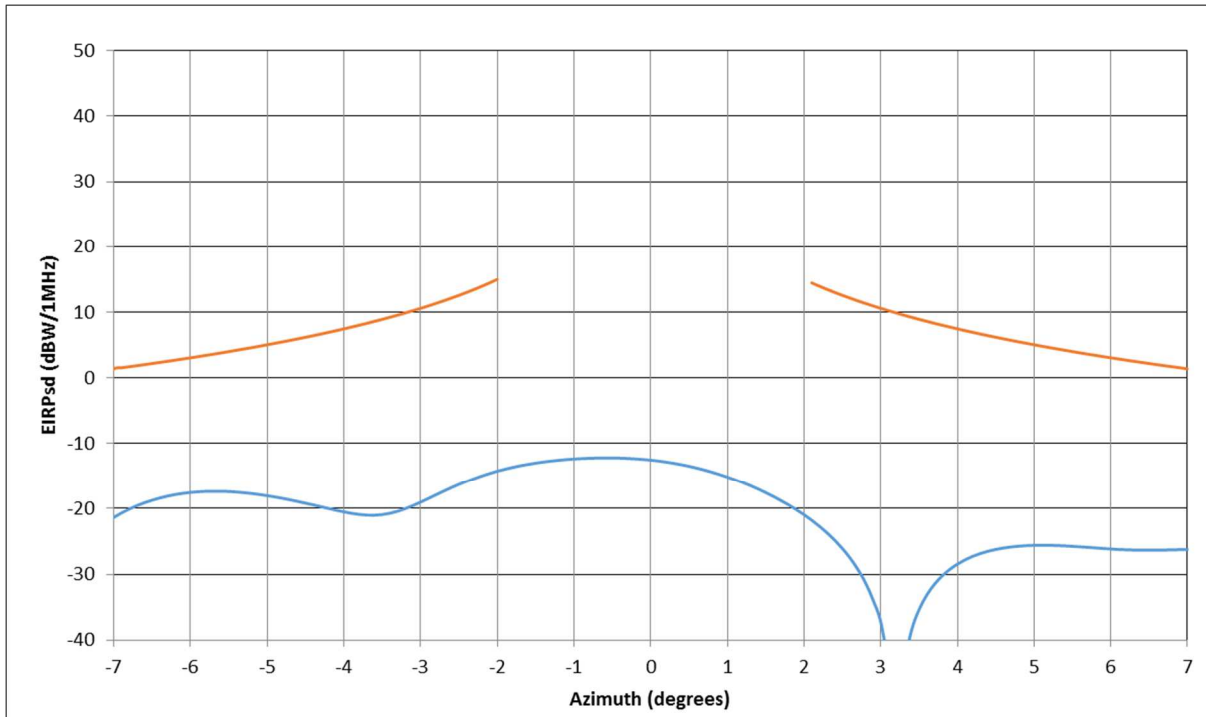




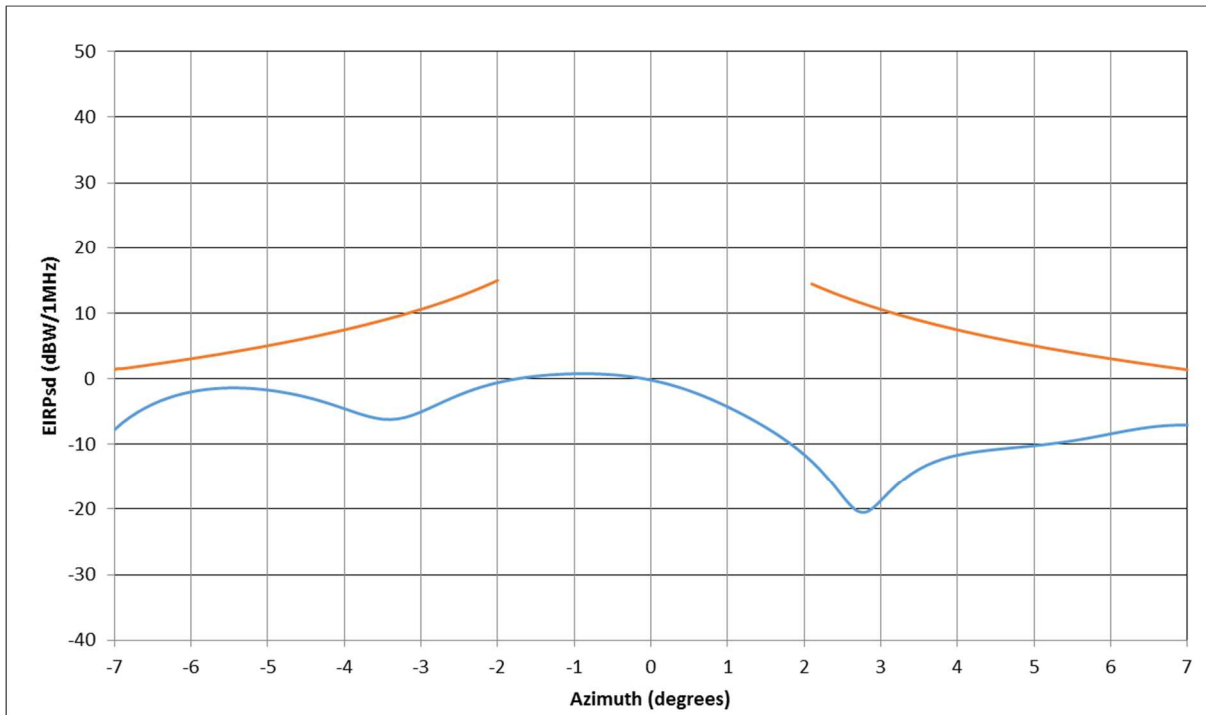
X-Pol EIRP density in the plane tangent to the GSO Arc 30 GHz (-7 to +7 degrees)



X-Pol EIRP density in the plane perpendicular to the GSO Arc 29.5 GHz (-7 to +7 degrees)

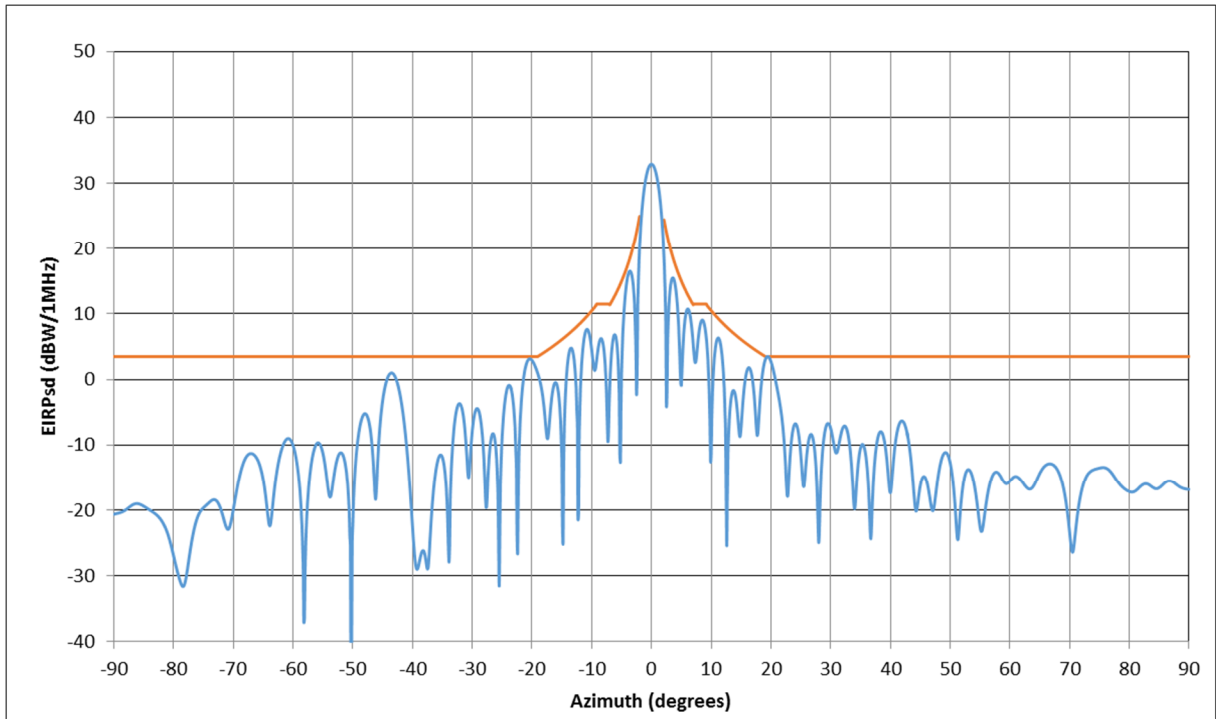


X-Pol EIRP density in the plane perpendicular to the GSO Arc 30 GHz (-7 to +7 degrees)

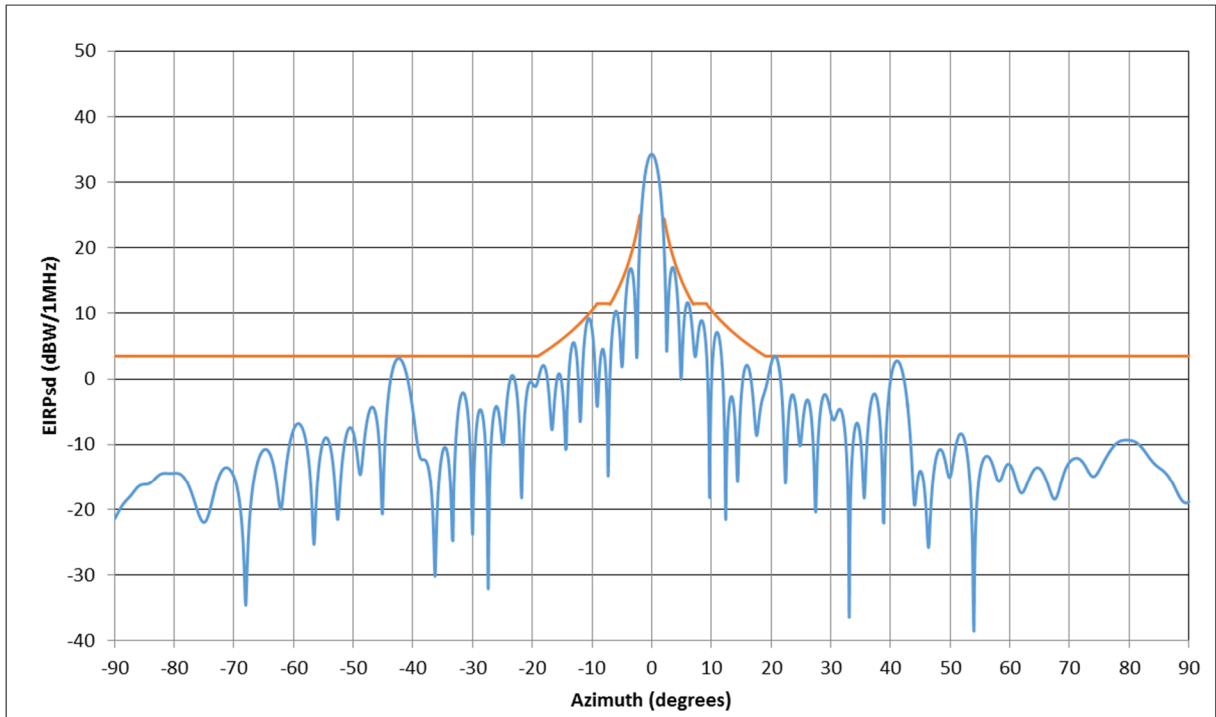


## 2.0 MilliSat-H Off-Axis EIRP Masks

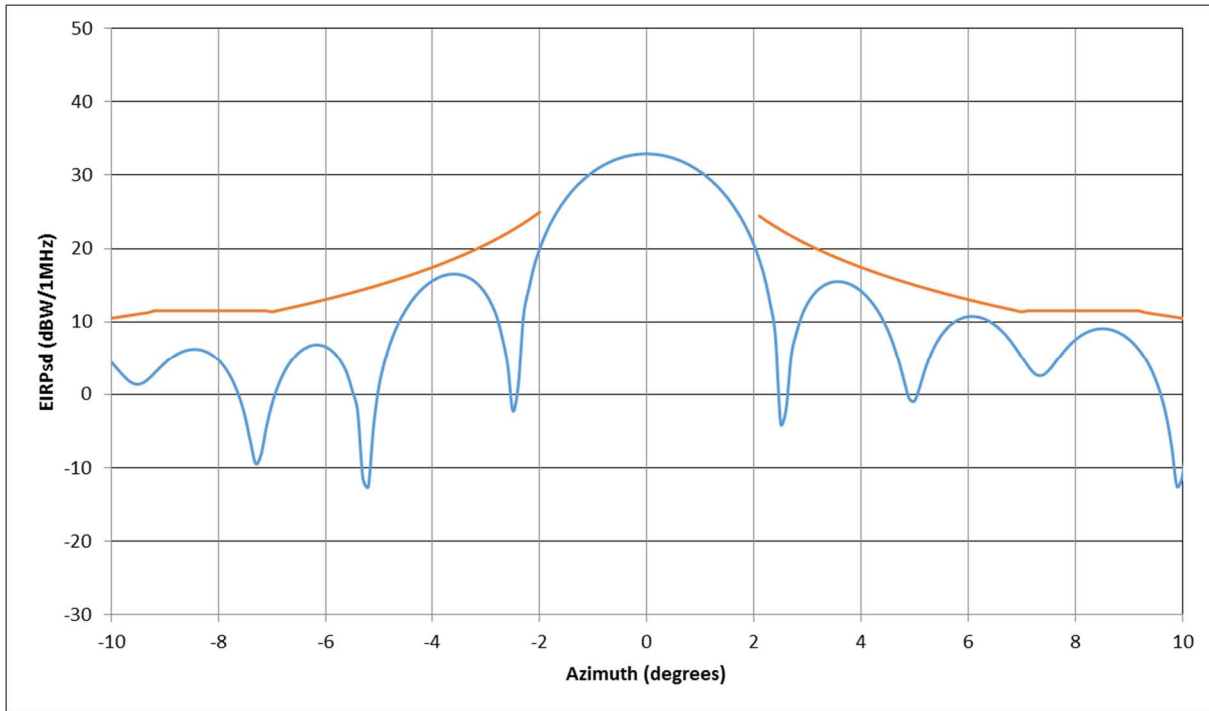
Co-Pol EIRP density in the Plane Tangent to the GSO Arc 29.5 GHz



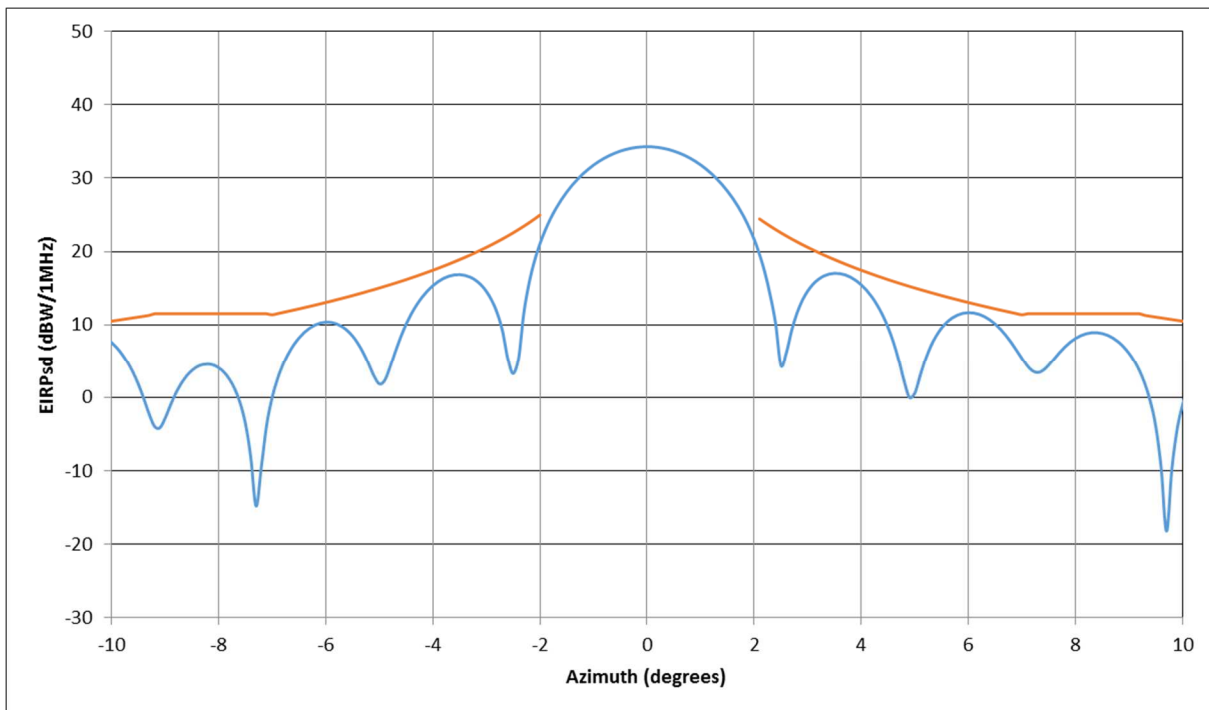
Co-Pol EIRP density in the Plane Tangent to the GSO Arc 30 GHZ



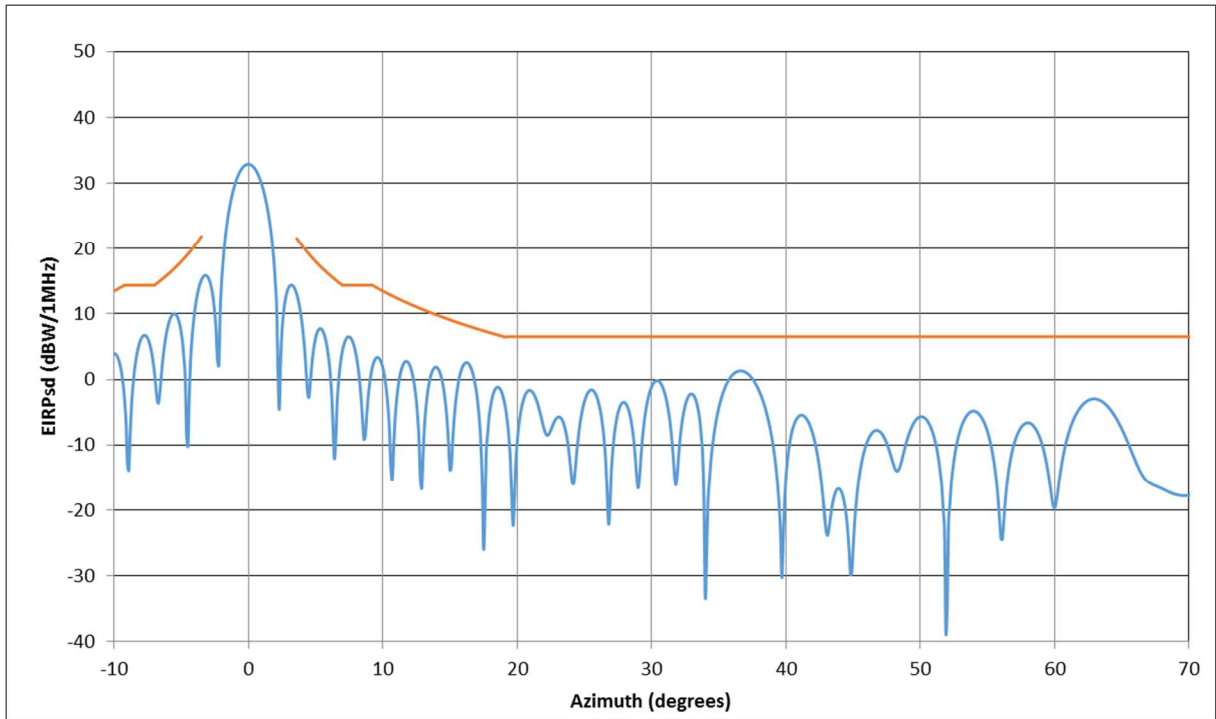
Co-Pol EIRP density in the Plane Tangent to the GSO Arc 29.5 GHz (-10 to +10 degrees)



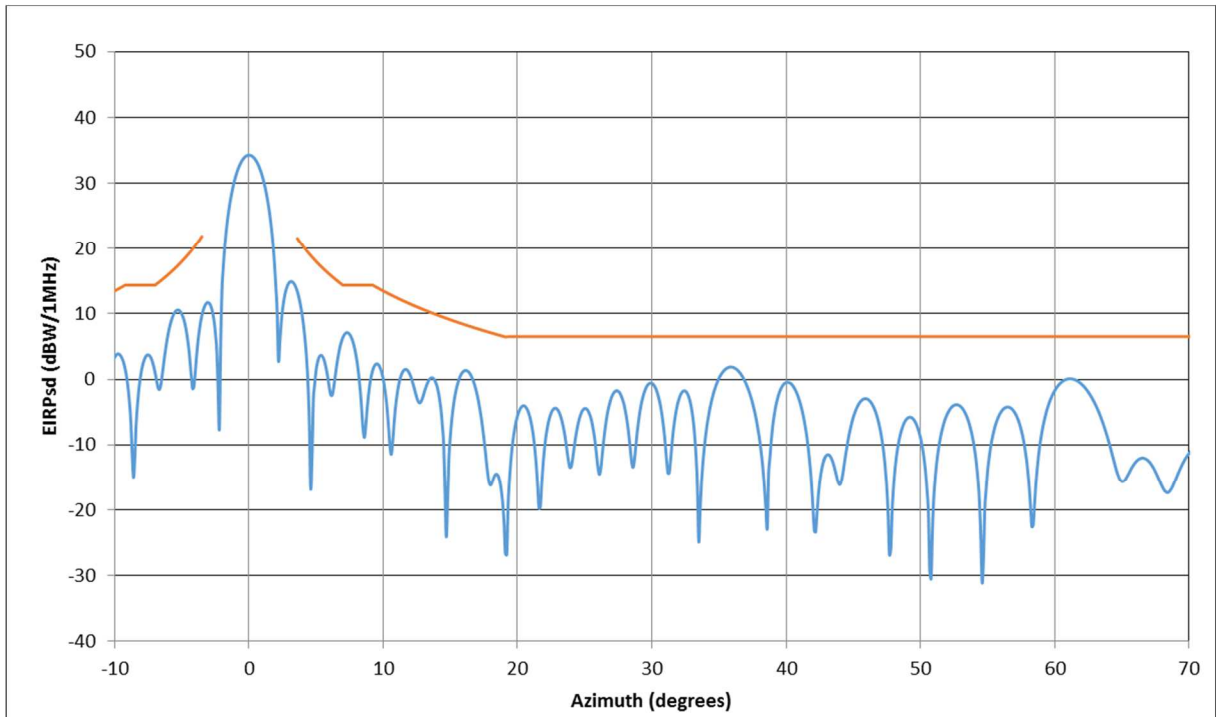
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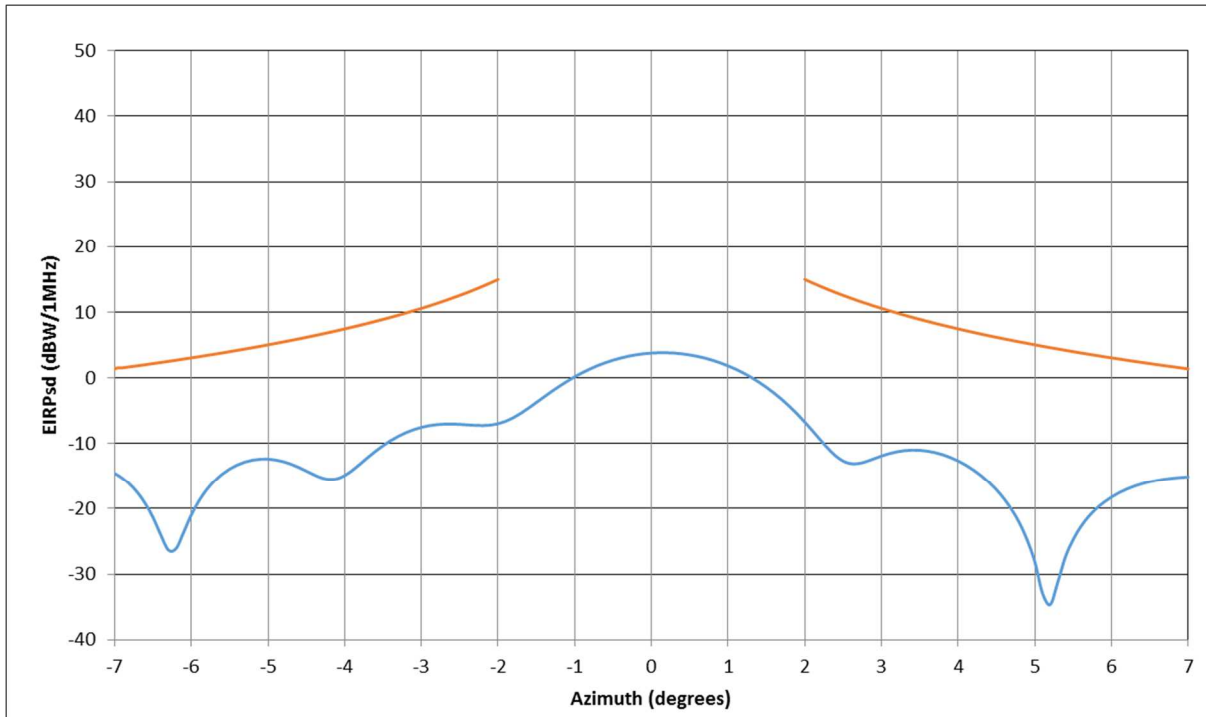
Co-Pol EIRP density in the Perpendicular to the GSO Arc 29.5 GHz (0 to +30 degrees)



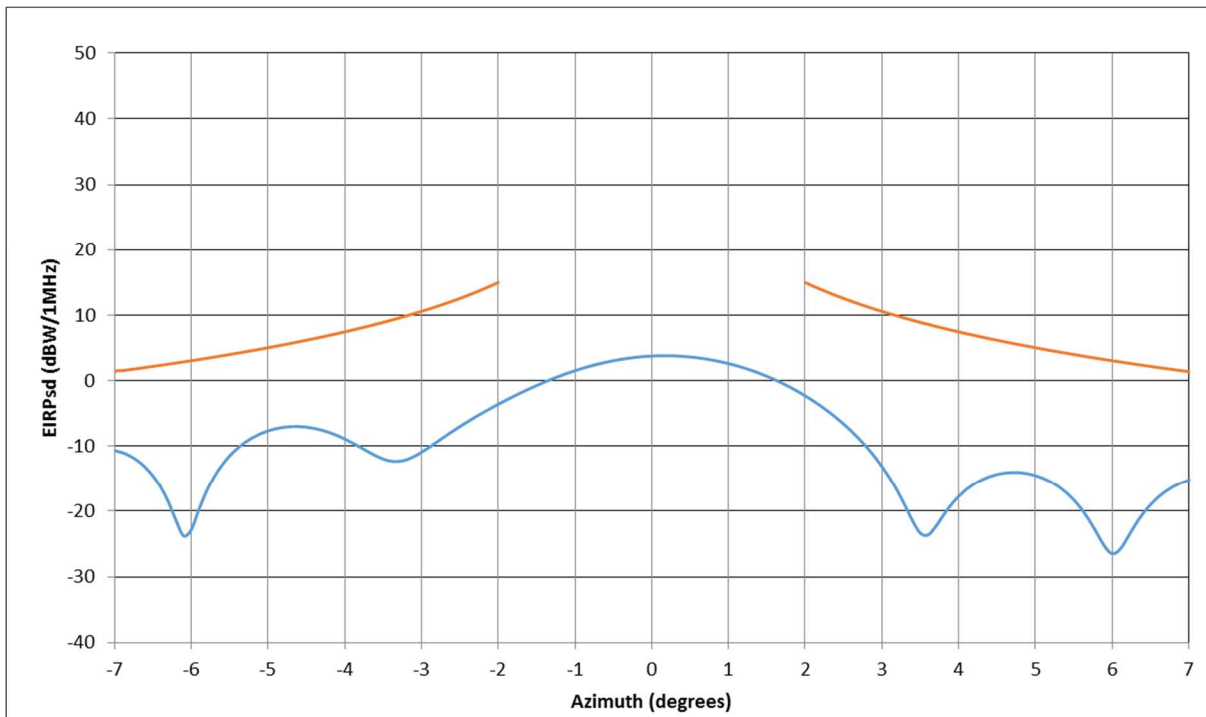
Co-Pol EIRP density in the Perpendicular to the GSO Arc 30.0 GHz (0 to +30 degrees)



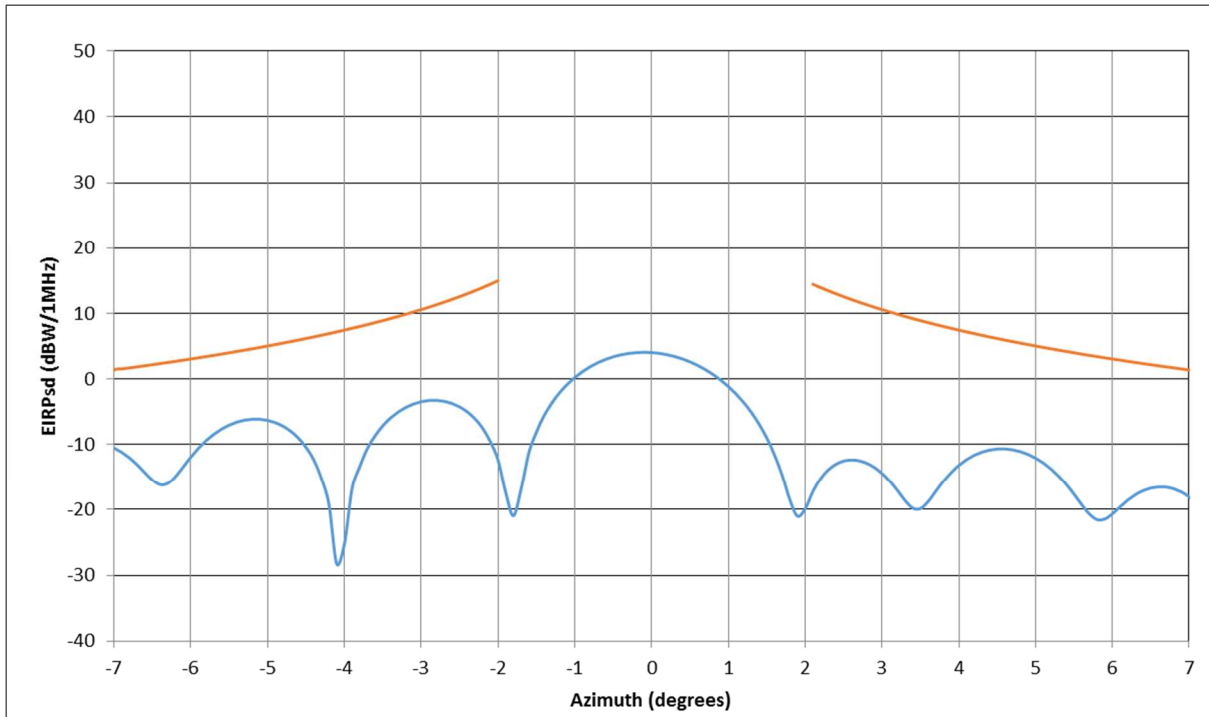
X-Pol EIRP density in the plane tangent to the GSO Arc 29.5 GHz (-7 to +7 degrees)



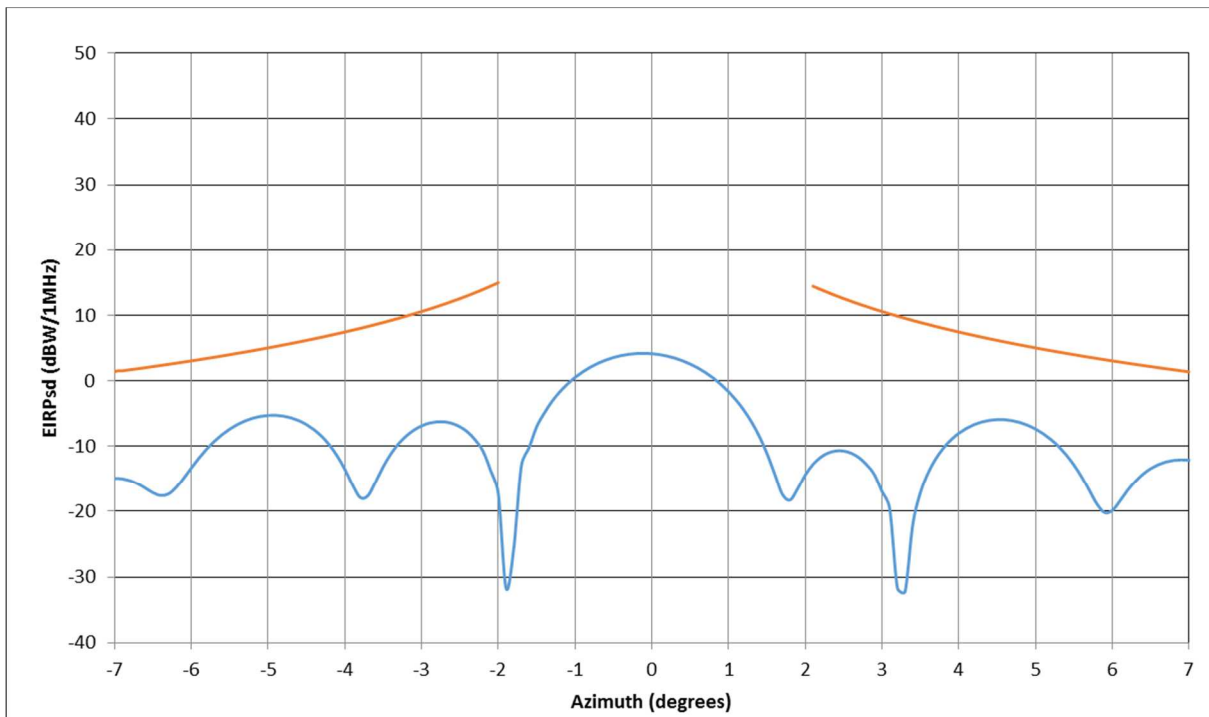
X-Pol EIRP density in the plane tangent to the GSO Arc 30.0 GHz (-7 to +7 degrees)



X-Pol EIRP density in the plane perpendicular to the GSO Arc 29.5 GHz (-7 to +7 degrees)

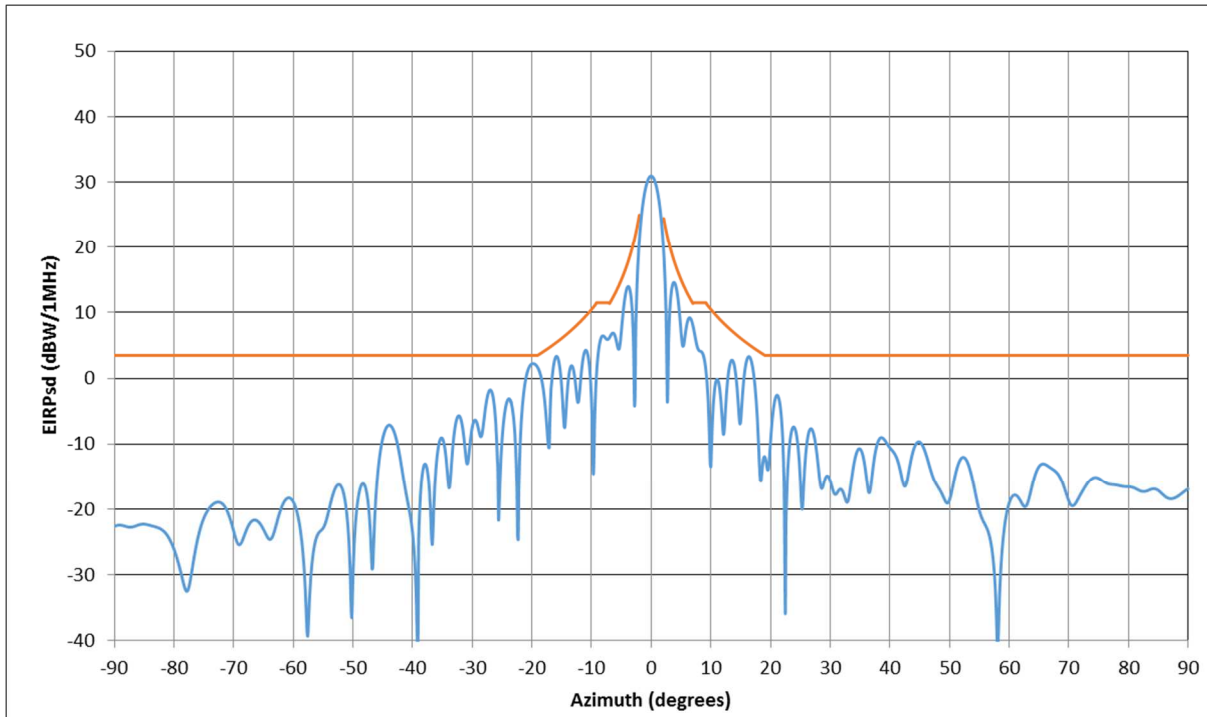


X-Pol EIRP density in the plane perpendicular to the GSO Arc 30.0 GHz (-7 to +7 degrees)

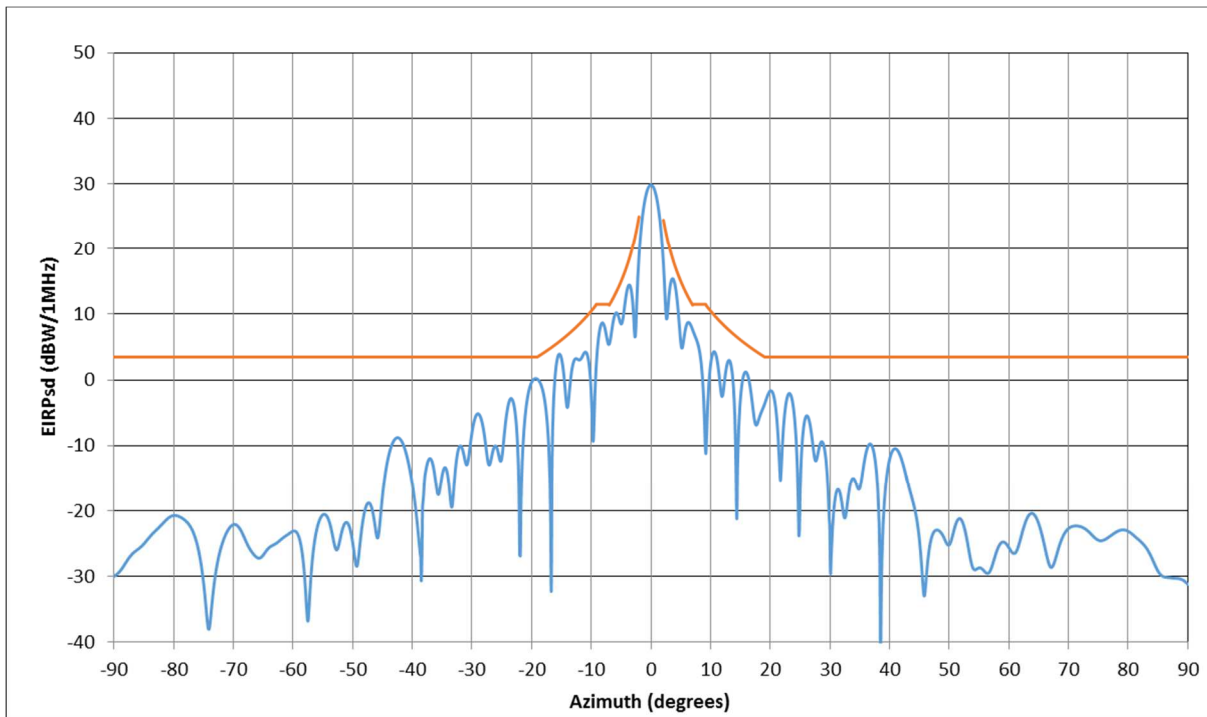


### 3.0 MicroSat Off-Axis EIRP Masks

Co-Pol EIRP density in the Plane Tangent to the GSO Arc 29.5 GHz

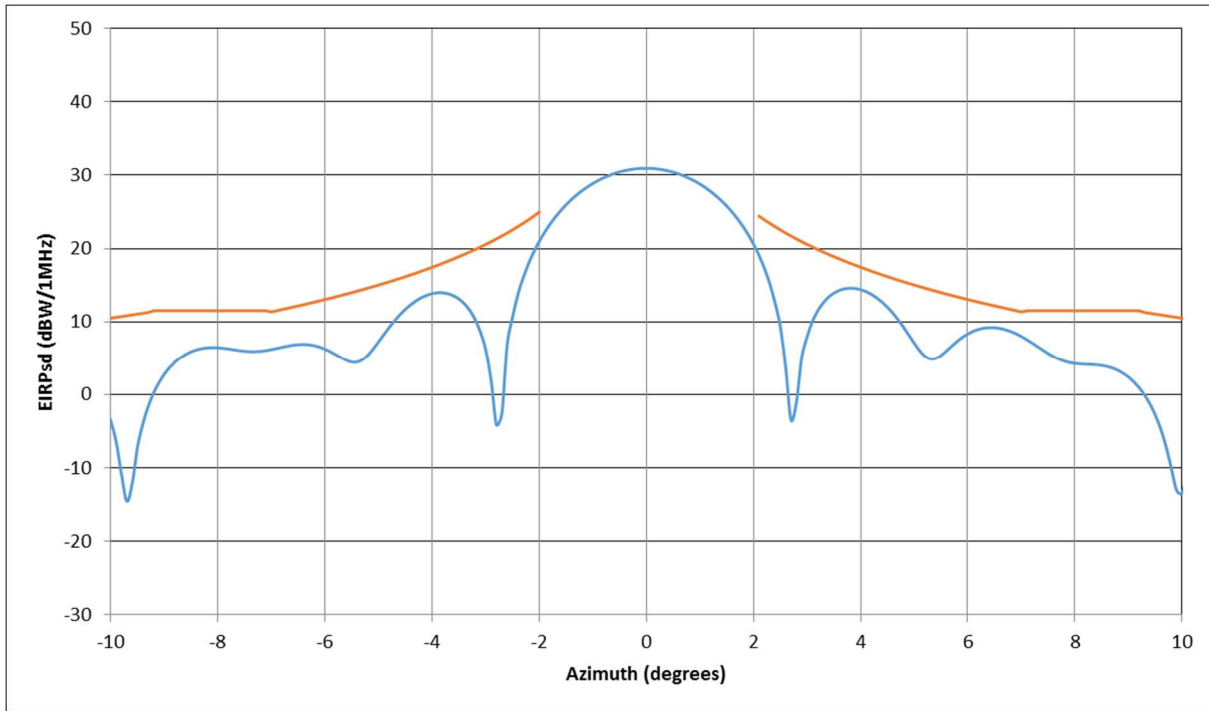


Co-Pol EIRP density in the Plane Tangent to the GSO Arc 30.0 GHz

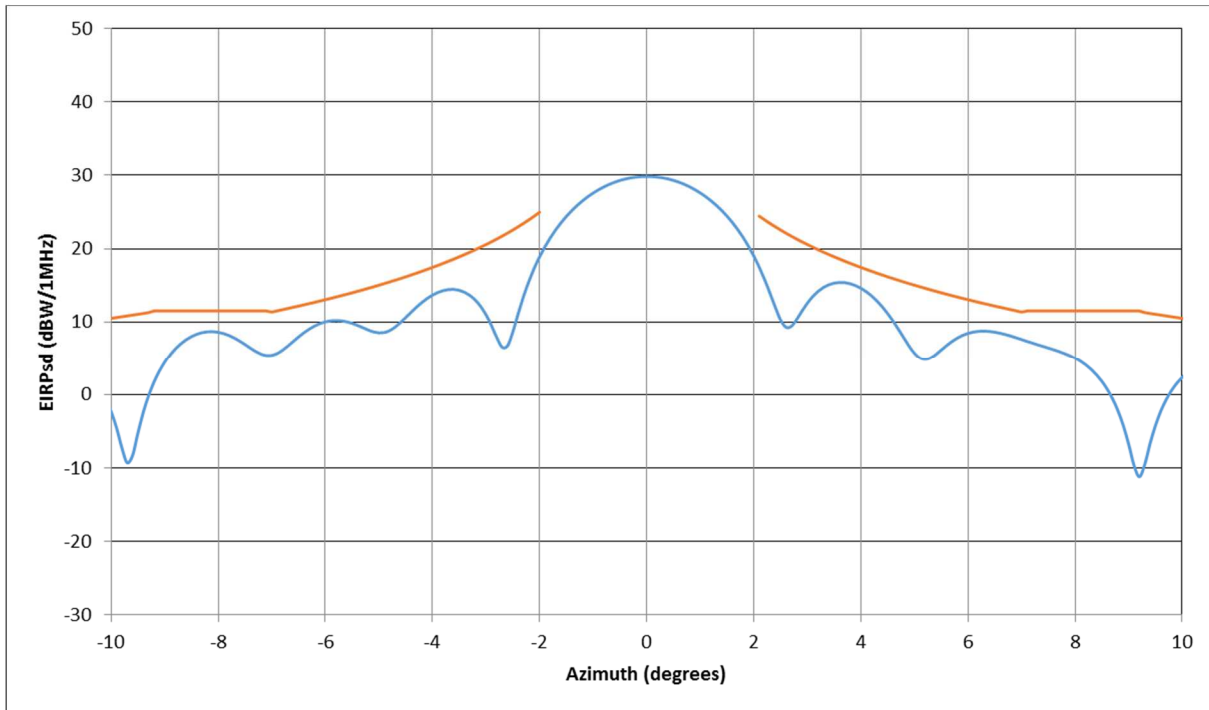


Co-Pol EIRP density in the Plane Tangent to the GSO Arc 29.5 GHz (-10 to +10 degrees)

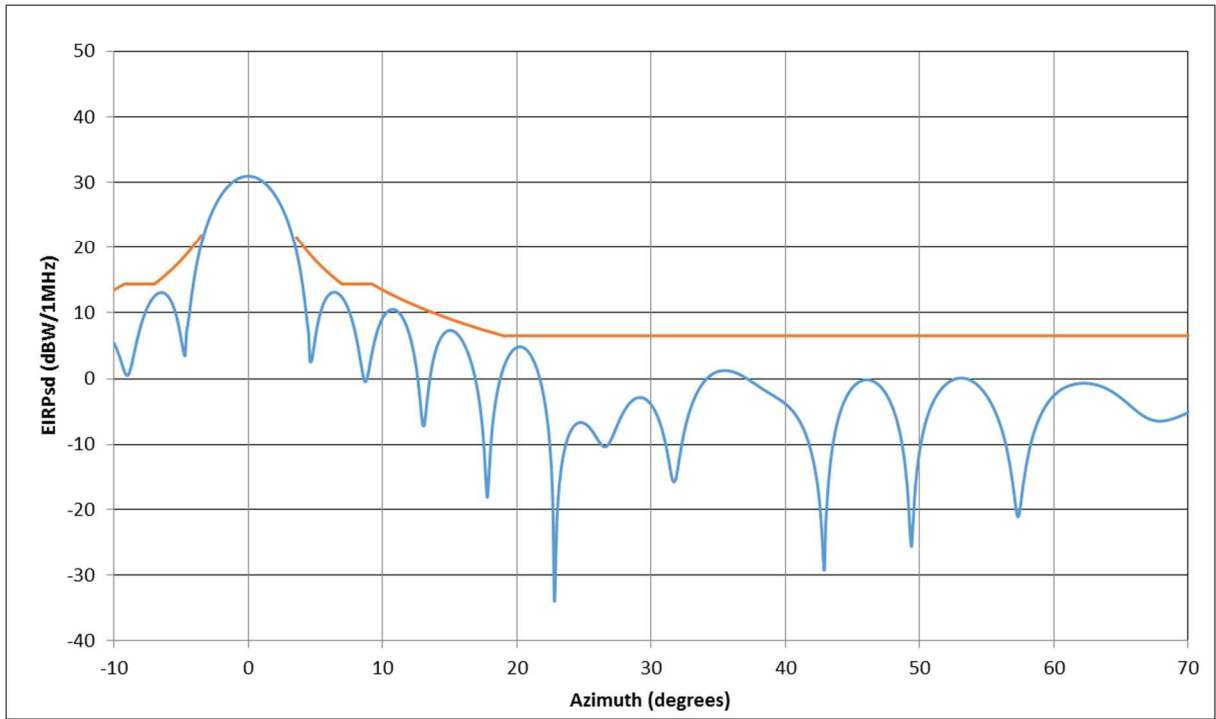




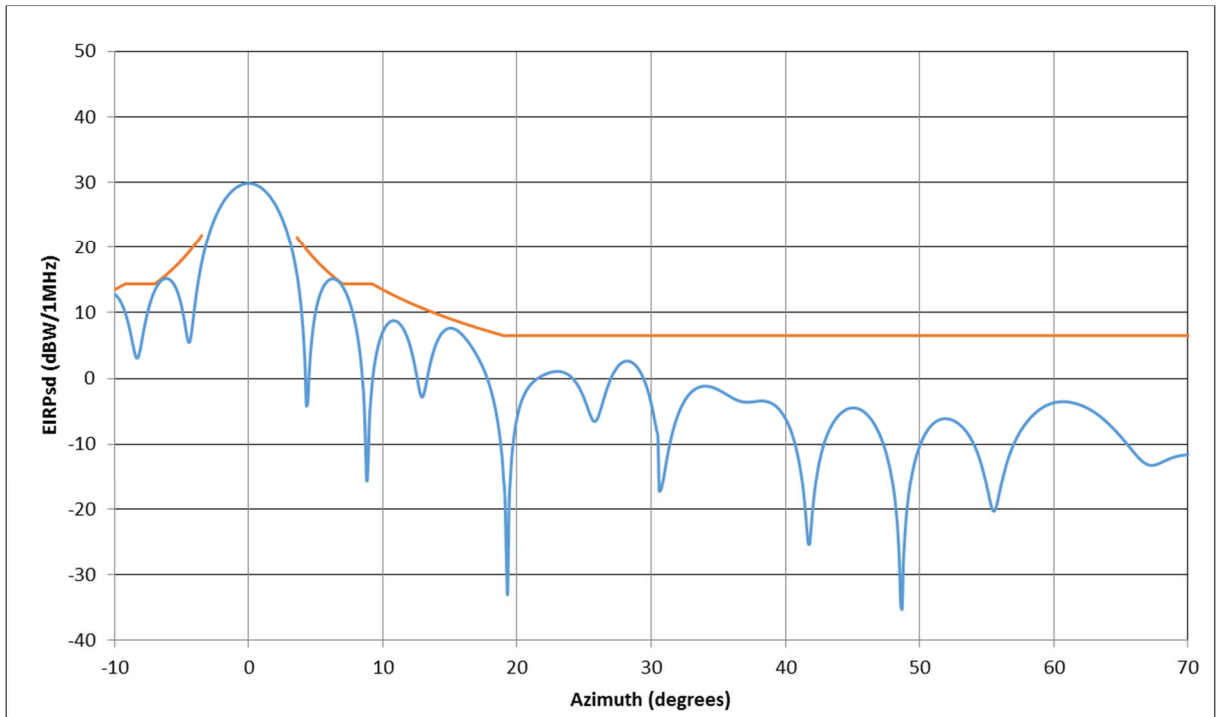
Co-Pol EIRP density in the Plane Tangent to the GSO Arc 30.0 GHz (-10 to +10 degrees)



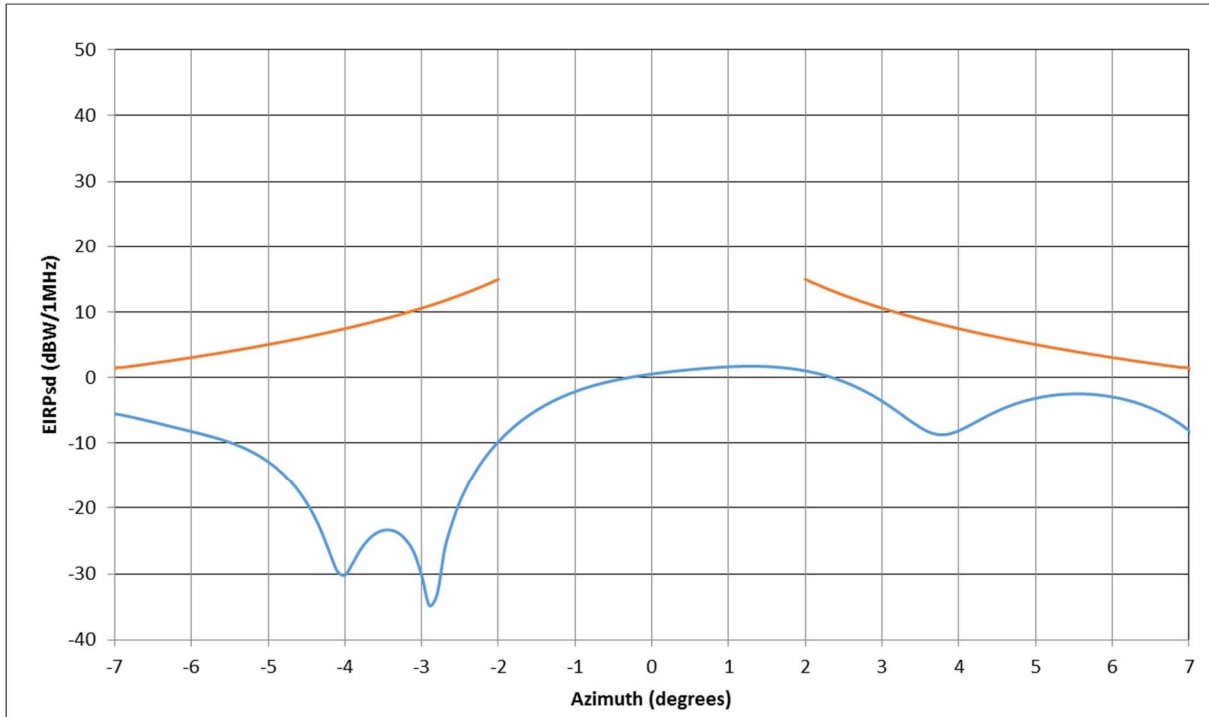
Co-Pol EIRP density in the Perpendicular to the GSO Arc 29.5 GHz (0 to +30 degrees)



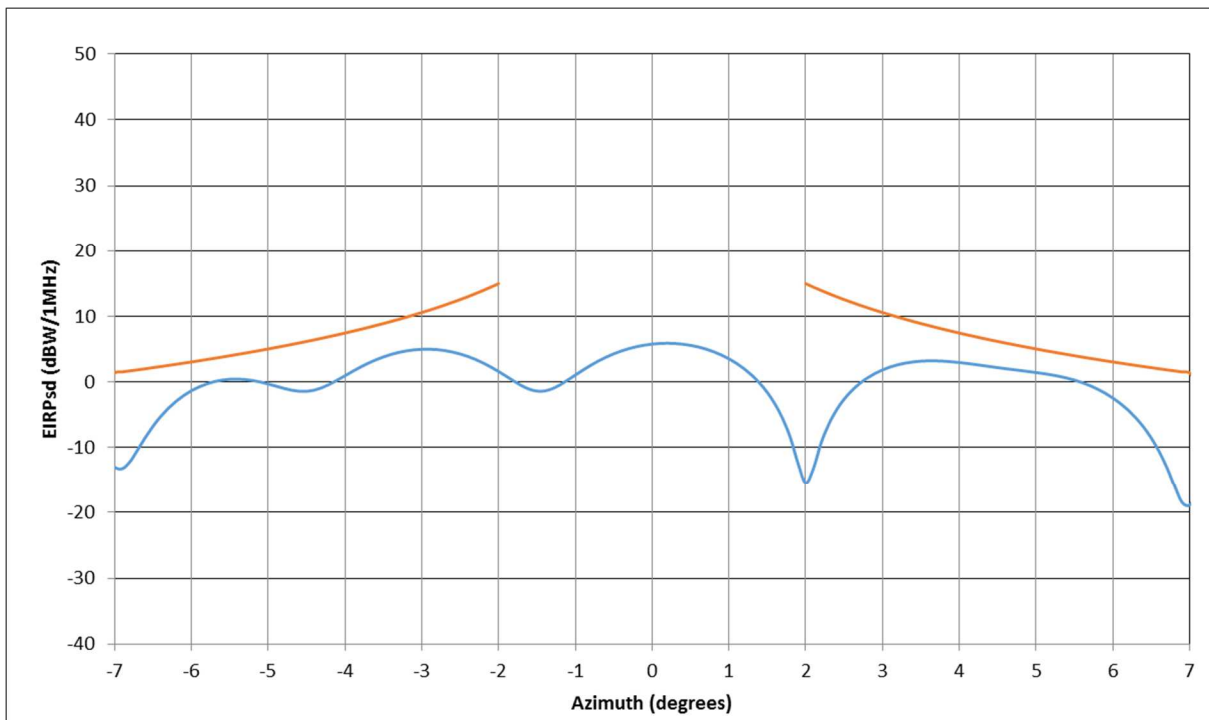
Co-Pol EIRP density in the Perpendicular to the GSO Arc 30.0 GHz (0 to +30 degrees)



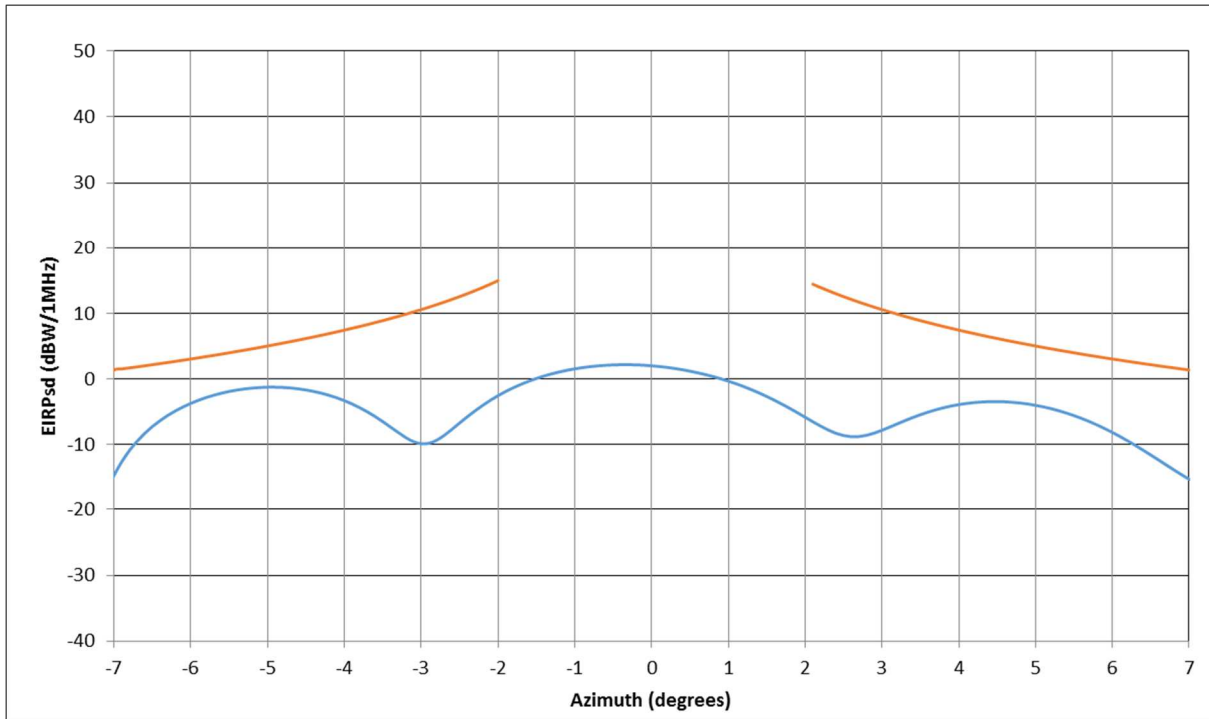
X-Pol EIRP density in the plane tangent to the GSO Arc 29.5 GHZ (-7 to +7 degrees)



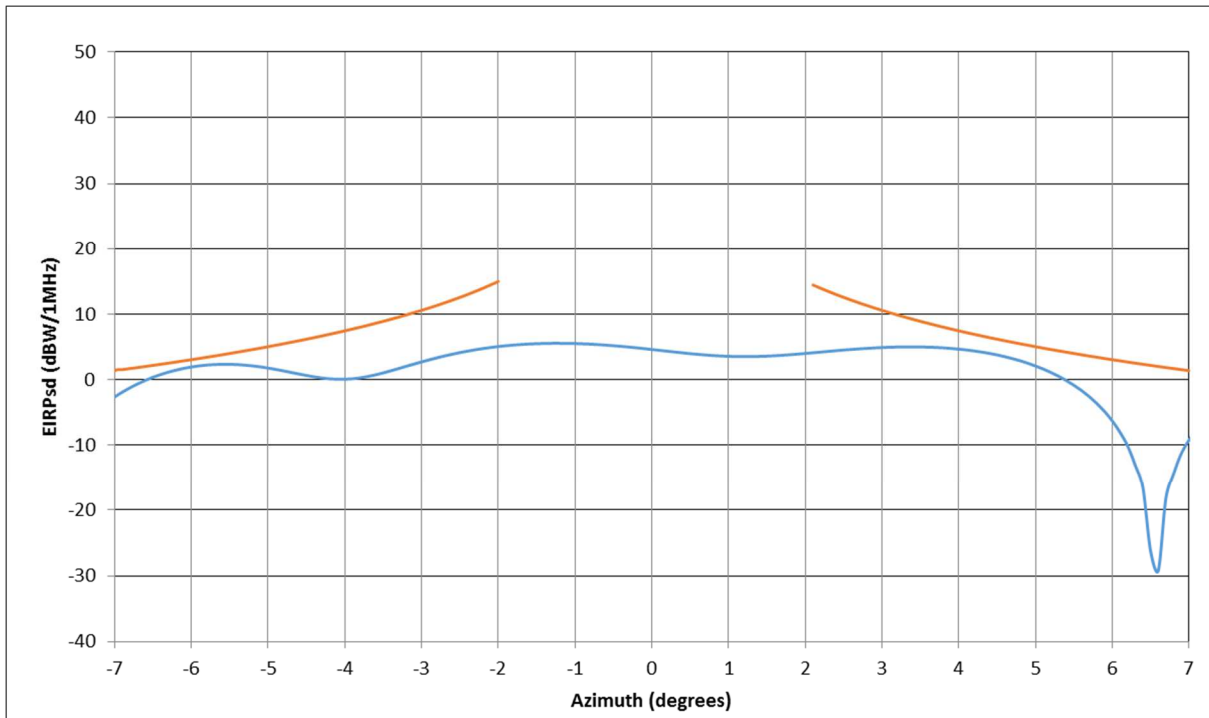
X-Pol EIRP density in the plane tangent to the GSO Arc 30.0 GHz (-7 to +7 degrees)



X-Pol EIRP density in the plane perpendicular to the GSO Arc 29.5 GHZ (-7 to +7 degrees)



X-Pol EIRP density in the plane tangent to the GSO Arc 30.0 GHz (-7 to +7 degrees)



**ISAT US Inc.**

**FCC Form 312 Exhibit C**

**Radiation Hazard Analysis**

**I. Introduction**

This Exhibit analyzes the non-ionizing radiation levels for the three GetSat Terminal earth stations included in this application. The analysis and calculations performed in this Exhibit comply with the methods described in the FCC Office of Engineering and Technology Bulletin, No. 65 first published in 1985 and revised in 1997 in Edition 97-01.

Bulletin No. 65 and the FCC R&O 96-326 specify two Maximum Permissible Exposure (MPE) limits that are dependent on the situation in which the exposure takes place and/or the status of the individuals who are subject to the exposure. These are described below:

- General Population/Uncontrolled environment MPE limit is 1 mW/cm<sup>2</sup>. The General Population /Uncontrolled MPE is a function of transmit frequency and is for an exposure period of thirty minutes or less.
- Occupational/Controlled environment MPE limit is 5 mW/cm<sup>2</sup>. The Occupational MPE is a function of transmit frequency and is for an exposure period of six minutes or less.

The analysis determined the power flux density levels of the earth station in the 1) far-field, 2) near-field, 3) transition region, and 4) at the main reflector surface. The analysis also examined the safe distance required to meet both the controlled and uncontrolled exposure limits. The summary of results and discussion is provided in Section 2 and the detailed analyses are provided in Section 3.

**II. Summary of Results**

The Tables below summarize the results for the proposed GetSat terminals. The analysis of the non-ionizing radiation levels, provided in Section 3, assumed the maximum allowed input power to antenna of 16W and a 100% duty cycle resulting in worst case radiation levels. In a significant number of deployments the terminal duty cycle would be below 100% and the actual power required would be lower than the 16W maximum resulting in lower radiation levels than those calculated. As with any directional antenna the maximum level of non-ionizing radiation is in the main beam of the antenna that is pointed to the satellite. As one moves around the antenna to the side lobes and back lobes the radiation levels decrease significantly. Thus, the maximum radiation level from an antenna occurs in a limited area in the direction the antenna is pointed to. This is especially true in the case of the GetSat terminals, as they utilize small, flat panel antennas that result in tighter beam-forming that concentrates the transmitted power in a smaller area around the main beam, resulting in higher calculated power density in the main beam but a sharp drop off in energy as one moves toward the side lobes.

The GetSat terminals are for commercial and government use and are not intended to be operated by the general public. The terminal is cost prohibitive for purchase by the general public, therefore it will only be operated by trained professional personnel. The antenna installers will be aware of the antenna's radiation environment and use measures best suited to maximize protection to anyone who may come into the proximity of the terminal.

As summarized in the tables below, the MilliSat-W antenna meets the FCC's MPE levels for controlled or uncontrolled environments beyond separation distances of about 9.5 m and 21 m, respectively. The MilliSat-H antenna meets the FCC's MPE levels for controlled or uncontrolled environments beyond separation distances of about 8.3 m and 18.5 m, respectively. The MicroSat antenna meets the FCC's MPE levels for controlled or uncontrolled environments beyond separation distances of about 6.2 m and 13.8 m, respectively. Based on these calculations, the MilliSat-W antenna meets the FCC's MPE levels for controlled environments in the far field of the antenna and exceeds the levels in the near field and the transition region, as well as on the aperture surface. The MilliSat-H and MicroSat antennas exceed the FCC's MPE levels for controlled environments in the near field, far field, and transition region, as well as on the aperture surface. Each of these antennas has the capability to exceed the FCC's MPE levels for uncontrolled environments in the near field, far field and transition regions and at the aperture surface. Since the antenna of each terminal will be enclosed within a radome, the aperture surface areas will not be accessible while the antenna is in operation. Training of personnel with access to the terminal would include consideration of the operational modes of the antenna and information on how to prevent radiation exposure, including disabling the communications system. The terminal is not designed to be serviceable in the field. If maintenance of the antenna requiring removal of the radome is necessary, this typically will be done at the manufacturer's facility, by trained technicians who will turn off the transmit power before performing work in these areas.

Additionally, there are various safety features associated with the operation and installation of the terminals that will prevent radiation exposure. The antenna will be installed on vehicles, and only at locations not accessible by the general population near the vehicles. Given that the antenna will not operate below elevation angles of five degrees, and that the terminal will be pointed upward toward the satellite - persons near the vehicle at ground level are unlikely to be exposed to the main beam of the antenna. Personnel will be trained to install and operate the terminals in a manner to ensure that any location where prolonged operation will occur is limited to locations such that areas where the limits for uncontrolled environments could be exceeded will be restricted to trained personnel. Furthermore, the manuals for these terminals will provide warnings regarding potential for radiation hazard, including a label attached to the surface of the terminal warning about the potential for radiation hazard, and a diagram showing the regions around the terminal where the radiation levels could exceed the maximum radiation exposure limit specified in 47 CFR §1.1310 Table 1, in accordance with the adopted but not yet published rules in §25.228(d).

The terminals also are designed to cease transmitting if the receive signal from the satellite is blocked, which could be caused by a person standing in front of the terminal or from other blockage. If the receive signal is blocked, the transmitter is shut down nearly instantaneously and will not resume operating until the signal from the satellite is reacquired. In fact there is a double shut down protection in the event that someone or something obstructs the RF path to the satellite. Not only does the terminal automatically turn off its Transmit capability if it loses the satellite Receive signal, i.e. the transmission path is compromised, but the radio frequency amplifier is additionally muted via its monitor and control so that no radio frequency can be transmitted. Especially given the small size of these flat panel antennas and their operational elevation angle, there is a high probability that any person passing close enough to the antenna to be exposed to its main beam would also block the RF path between the terminal and the satellite triggering the automatic shutdown mechanism. As a result of this automatic shutdown mechanism, the maximum continuous time that a person could be exposed

to the main beam transmissions at any power level would be significantly less than one second before the antenna would cease transmitting.

Finally, the software interface for the terminals also includes the ability to set up three-dimensional blocking zones that will prevent the terminal from transmitting in certain set directions relative to the terminal's place of installation. This would allow the trained personnel installing and operating the terminal to ensure that the terminal will never transmit when it is pointed at areas where people are likely to be present.

In conclusion, the results of the analysis combined with the design and operational characteristics of the terminals show that the GetSat terminals, operating while in-motion, or when located in a controlled environment, and under the proper mitigation procedures, meet the guidelines specified in § 1.1310 of the Regulations.

**MilliSat-W Terminal**

Region	Distance (m)	Calculated Power Density (mW/cm <sup>2</sup> )	Limit Controlled Environment ≤ 5 mW/cm <sup>2</sup>	Limit Uncontrolled Environment ≤ 1 mW/cm <sup>2</sup>
Safe Range for Uncontrolled	≥21.02	1.0	Meets Limit	Meets Limit
Safe Range for Controlled	≥9.40	5.0	Meets Limit	Exceeds Limit
Near Field	6.3	18.91	Exceeds Limit	Exceeds Limit
Far Field	15.0	1.96	Meets Limit	Exceeds Limit
Transition Region	6.3	18.91	Exceeds Limit	Exceeds Limit
Aperture Surface	NA	94.81	Exceeds Limit	Exceeds Limit

**MilliSat-H Terminal**

Region	Distance (m)	Calculated Power Density (mW/cm <sup>2</sup> )	Limit Controlled Environment ≤ 5 mW/cm <sup>2</sup>	Limit Uncontrolled Environment ≤ 1 mW/cm <sup>2</sup>
Safe Range for Uncontrolled	≥18.51	1.0	Meets Limit	Meets Limit
Safe Range for Controlled	≥8.28	5.0	Meets Limit	Exceeds Limit
Near Field	1.8	64.83	Exceeds Limit	Exceeds Limit
Far Field	4.4	17.95	Exceeds Limit	Exceeds Limit
Transition Region	1.8	64.83	Exceeds Limit	Exceeds Limit
Aperture Surface	NA	95.58	Exceeds Limit	Exceeds Limit

**MicroSat Terminal**

Region	Distance (m)	Calculated Power Density (mW/cm <sup>2</sup> )	Limit Controlled Environment ≤ 5 mW/cm <sup>2</sup>	Limit Uncontrolled Environment ≤ 1 mW/cm <sup>2</sup>
Safe Range for Uncontrolled	≥13.80	1.0	Meets Limit	Meets Limit
Safe Range for Controlled	≥6.17	5.0	Meets Limit	Exceeds Limit
Near Field	1.8	64.83	Exceeds Limit	Exceeds Limit
Far Field	4.4	9.98	Exceeds Limit	Exceeds Limit
Transition Region	1.8	64.83	Exceeds Limit	Exceeds Limit
Aperture Surface	NA	191.16	Exceeds Limit	Exceeds Limit

### III. Detailed Calculations

#### Millisat-W Terminal

Input Parameter	Value	Units	Symbol
Antenna Major Axis Dimension	0.5	m	D
Antenna Transmit Gain @30 GHz	35.4	dBi	G
Transmit Frequency	30000	MHz	F
Power Input to the Antenna	16	Watts	P
Antenna Surface Area	675	cm <sup>2</sup>	A
Antenna Efficiency	0.58	Real	η

Calculated Parameter	Value	Units	Symbol	Formula
Gain Factor	3467.37	Real	g	10 <sup>^(G/10)</sup>
Wavelength	0.01	m	λ	300/f

#### Antenna Field Distances

Calculated Parameter	Value	Units	Symbol	Formula
Near-Field Distance	6.25	m	R <sub>nf</sub>	D <sup>2</sup> /(4λ)
Distance to Far-Field	15.00	m	R <sub>ff</sub>	0.6D <sup>2</sup> /λ
Distance of Transition Range	6.25	m	R <sub>t</sub>	R <sub>t</sub> =R <sub>nf</sub>

#### Power Density

Calculated Parameter	Value	Units	Symbol	Formula
Power Density in the Near Field	18.91	mW/cm <sup>2</sup>	S <sub>nf</sub>	16ηP/(πD <sup>2</sup> )
Power Density in the Far Field	1.96	mW/cm <sup>2</sup>	S <sub>ff</sub>	gP/(4πR <sub>ff</sub> <sup>2</sup> )
Power Density in the Transition Region	18.91	mW/cm <sup>2</sup>	S <sub>t</sub>	S <sub>nf</sub> *R <sub>nf</sub> /R <sub>t</sub>
Power Density at Aperture Surface	94.81	mW/cm <sup>2</sup>	S <sub>surface</sub>	4P/A

Distance to 1 mW/cm<sup>2</sup> 21.02 m



Distance to 5 mW/cm<sup>2</sup> 9.40 m

### Millisat-H Terminal

Input Parameter	Value	Units	Symbol
Antenna Major Axis Dimension	0.27	m	D
Antenna Transmit Gain @30 GHz	34.3	dBi	G
Transmit Frequency	30000	MHz	F
Power Input to the Antenna	16	Watts	P
Antenna Surface Area	669.6	cm <sup>2</sup>	A
Antenna Efficiency	0.58	Real	η

Calculated Parameter	Value	Units	Symbol	Formula
Gain Factor	2691.53	Real	g	10 <sup>^(G/10)</sup>
Wavelength	0.01	m	λ	300/f

#### Antenna Field Distances

Calculated Parameter	Value	Units	Symbol	Formula
Near-Field Distance	1.82	m	Rnf	D <sup>2</sup> /(4λ)
Distance to Far-Field	4.37	m	Rff	0.6D <sup>2</sup> /λ
Distance of Transition Range	1.82	m	Rt	Rt=Rnf

#### Power Density

Calculated Parameter	Value	Units	Symbol	Formula
Power Density in the Near Field	64.83	mW/cm <sup>2</sup>	Snf	16ηP/(πD <sup>2</sup> )
Power Density in the Far Field	17.95	mW/cm <sup>2</sup>	Sff	gP/(4πRff <sup>2</sup> )
Power Density in the Transition Region	64.83	mW/cm <sup>2</sup>	St	Snf*Rnf/Rt
Power Density at Aperture Surface	95.58	mW/cm <sup>2</sup>	Ssurface	4P/A

Distance to 1 mW/cm<sup>2</sup> 18.51 m  
 Distance to 5 mW/cm<sup>2</sup> 8.28 m

### MicroSat

Input Parameter	Value	Units	Symbol
Antenna Major Axis Dimension	0.27	m	D
Antenna Transmit Gain @30 GHz	31.75	dBi	G
Transmit Frequency	30000	MHz	F
Power Input to the Antenna	16	Watts	P
Antenna Surface Area	334.8	cm <sup>2</sup>	A
Antenna Efficiency	0.58	Real	η

Calculated Parameter	Value	Units	Symbol	Formula
Gain Factor	1496.24	Real	g	$10^{(G/10)}$
Wavelength	0.01	m	$\lambda$	$300/f$

#### Antenna Field Distances

Calculated Parameter	Value	Units	Symbol	Formula
Near-Field Distance	1.82	m	Rnf	$D^2/(4\lambda)$
Distance to Far-Field	4.37	m	Rff	$0.6D^2/\lambda$
Distance of Transition Range	1.82	m	Rt	$Rt=Rnf$

#### Power Density

Calculated Parameter	Value	Units	Symbol	Formula
Power Density in the Near Field	64.83	mW/cm <sup>2</sup>	Snf	$16\eta P/(\pi D^2)$
Power Density in the Far Field	9.98	mW/cm <sup>2</sup>	Sff	$gP/(4\pi R_{ff}^2)$
Power Density in the Transition Region	64.83	mW/cm <sup>2</sup>	St	$S_{nf} * R_{nf} / R_t$
Power Density at Aperture Surface	191.16	mW/cm <sup>2</sup>	Ssurface	$4P/A$

Distance to 1 mW/cm <sup>2</sup>	13.80	m		
Distance to 5 mW/cm <sup>2</sup>	6.17	m		

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