

TECHNICAL APPENDIX
Intelsat License LLC
ESIM Blanket License Application

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I. Technical Description

The Intelsat License LLC (“Intelsat”) earth station aboard aircraft (“ESAA”) network is comprised of: (i) ESAA terminals mounted on the tail of commercial aircraft; (ii) a fleet of commercial Ku-band traditional and HTS satellites within Permitted list; and (iii) Intelsat-owned or leased teleport antennas which provide uplink and downlink connectivity. The ESAA terminals will be monitored and controlled by the Internet Secure Operating Center in Ellenwood, Georgia, United States on a 24/7 basis.

In this ESAA license application, Intelsat seeks to license – SD ATMA 0.23 m Ku-Band – in an *ESAA Blanket License* for operations with previously authorized satellite points of communication and any U.S.-licensed or non-U.S. licensed satellite on the Commission’s Permitted Space Station List. Below, Intelsat provides additional information on its proposed terminal operations. The information provided herein satisfies the Commission’s requirements for ESAA operations.

Plane Simple™ Tail-Mount Terminal

The Plane Simple™ Tail-Mount Terminal is an ESIM terminal that will enable Intelsat to provide two-way broadband communications in Ku-band FSS spectrum consistent with the Commission’s ESAA rules, 47 C.F.R. §25.218, and other applicable Commission rules and policies. The Plane Simple™ Tail-Mount terminal is shown in Figure 1 and the control parameters of the terminal are summarized in Table 1 below.



Figure 1: Plane Simple™ Tail-Mount Terminal

Parameter	Performance
Operational Azimuth Range	Continuous, 360°
Operational Elevation Range	0° to 90°
Pointing Accuracy Azimuth	0.2°
Pointing Accuracy Elevation	0.2°
Azimuth, Elevation, Polarization Rates of Change	30°/s
Azimuth, Elevation, Polarization Acceleration	30°/s ²

Table 1 Summary of Control Parameters Plane Simple™ Tail-Mount Terminal

Components and Characteristics

The Plane Simple™ Tail-Mount Terminal is comprised of the following components:

- Advanced Tail Mount Antenna (ATMA)
- Satcom Direct Modem Unit (SMU)

The ATMA affixes the terminal to the aircraft tail and has been certified for in-flight use. The ATMA's integrated Antenna Control Unit (ACU) self-monitors for any condition that would cause the terminal to exceed its authorized off-axis EIRP density limits in the case of GSO FSS ESIMs. In the presence of these conditions, the terminal will automatically cease transmissions within 100 milliseconds, and not resume transmissions until the condition that caused the ESIM to exceed those limits is corrected.

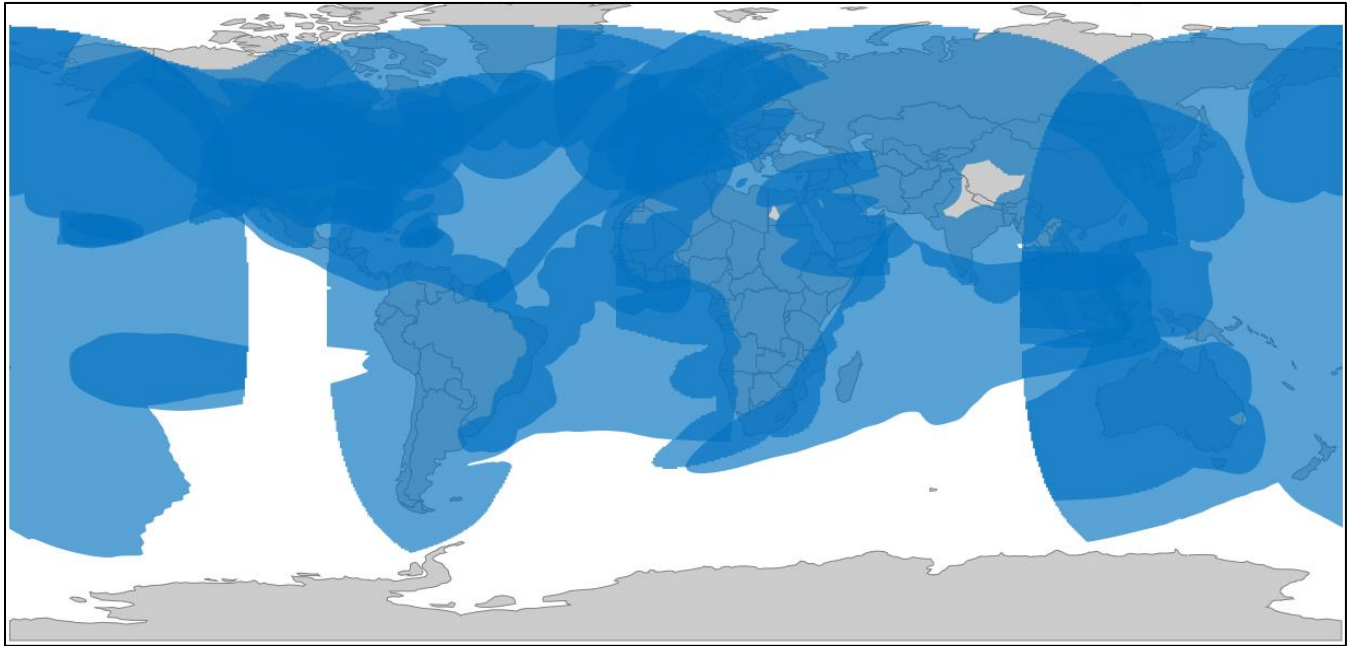
The terminal also will cease transmissions automatically if:

- The ATMA loses communication with the SMU.
- the SMU loses communication with the aircraft inertial navigation system ("INS").
- the modem (enclosed within the SMU) loses receive signal from the satellite.
- the reference signal from the modem is interrupted.
- the BUC reaches an over-temperature condition (85°C).
- the ATMA input power is interrupted.

The ATMA's combined block up converter and power amplifier (BUC) has been calibrated at the factory ensuring minimum variations in gain over temperature and frequency. The power detector within the BUC is calibrated over frequency and temperature and accurately reports transmit output power. The network commissioned terminal ensures compliance with applicable power spectral density ("PSD") limits.

Coverage Map

The geographical coverage of the Intelsat ESAA operations is depicted below.



III. Compliance with 47 CFR §25.205 (b)

Intelsat agrees to comply that “ESAA’s in aircraft on the ground must not transmit at elevation angles less than three degrees. There is no minimum angle of antenna elevation for ESAA’s while airborne.”

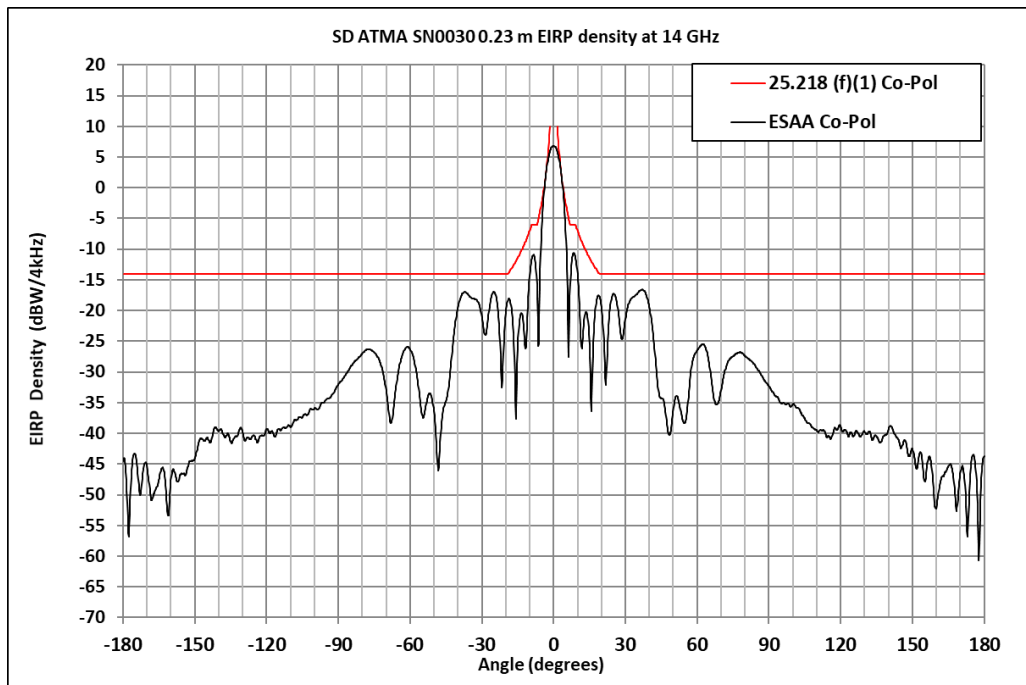
IV. Compliance to 47 C.F.R. §25.218 (f)(1-3)

SPECTRAL DENSITY FOR SD ATMA SN0030 0.23m Terminal

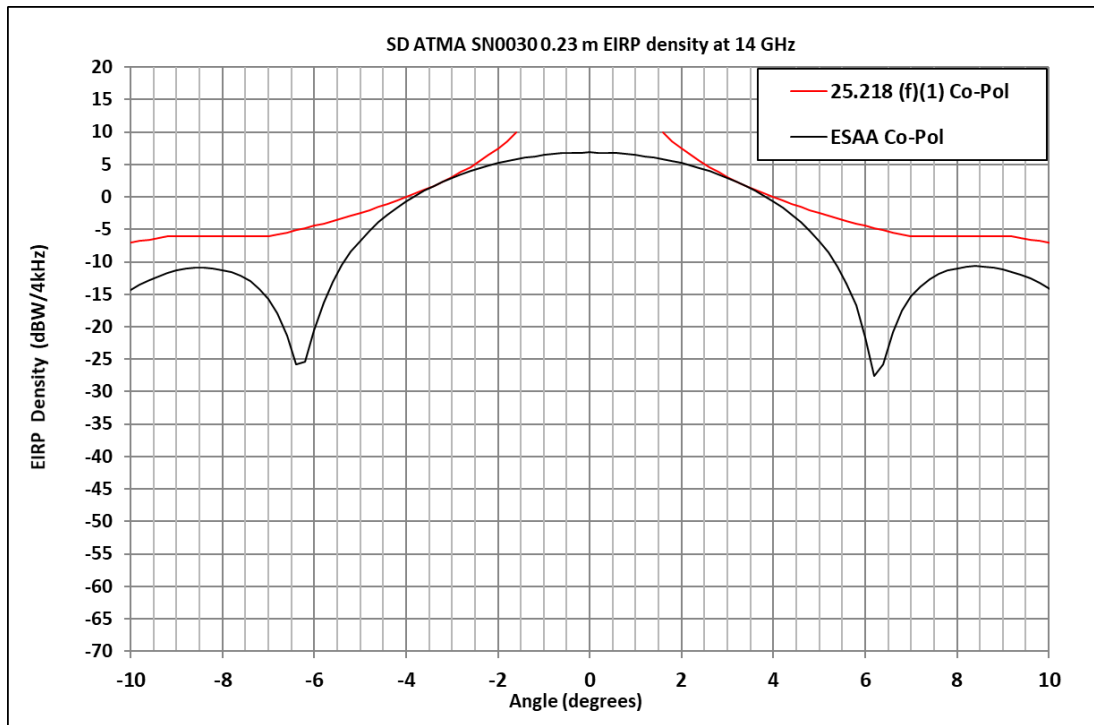
To ensure the EIRP spectral density envelopes specified in §25.218(f) 1-3 are satisfied, the maximum EIRP spectral density is limited to 7.2 dBW/4 kHz at 14.5 GHz. The EIRP density compliance for this terminal is shown below.

1. EIRP density plots (14 GHz, peak EIRP/density – 6.9 dBW/ 4KHz)

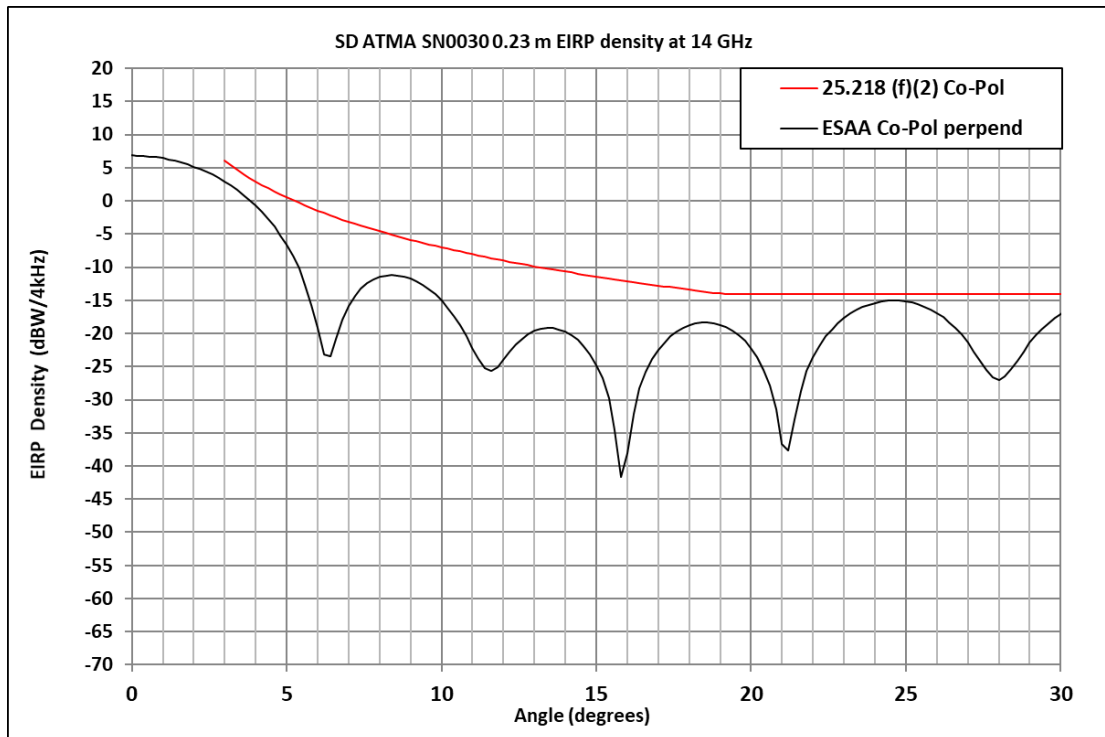
(i) Co-Pol EIRP density in the plane tangent to the GSO arc



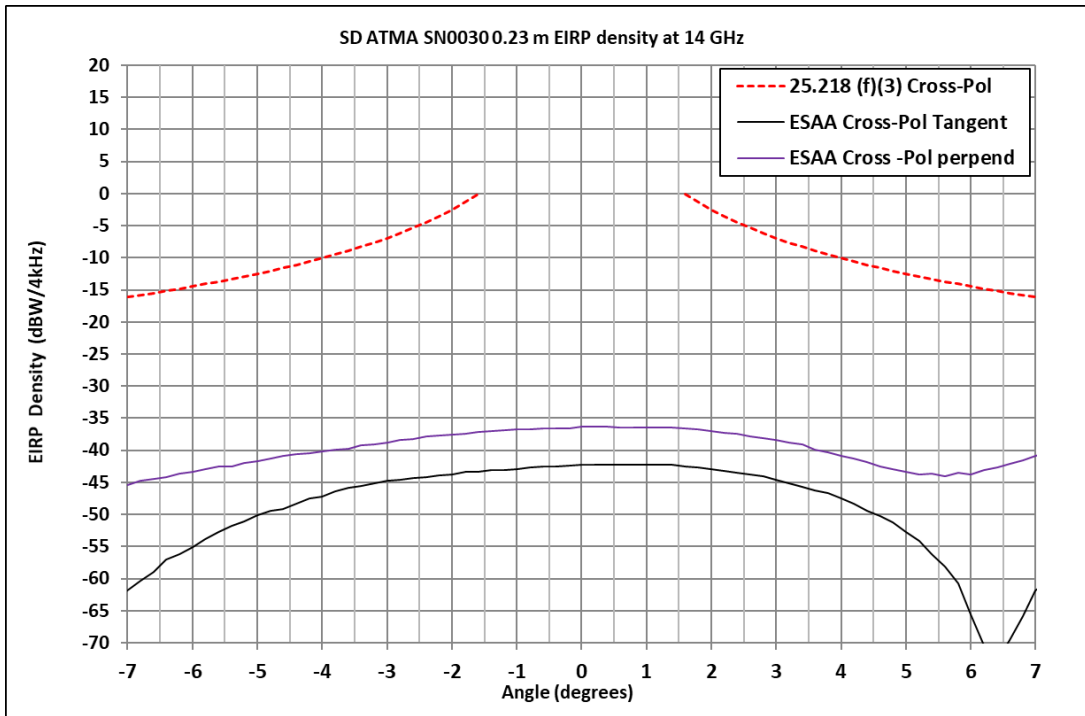
(ii) Co-Pol EIRP density in the plane tangent to the GSO arc



(iii) Co-Pol EIRP density in the plane perpendicular to the GSO arc

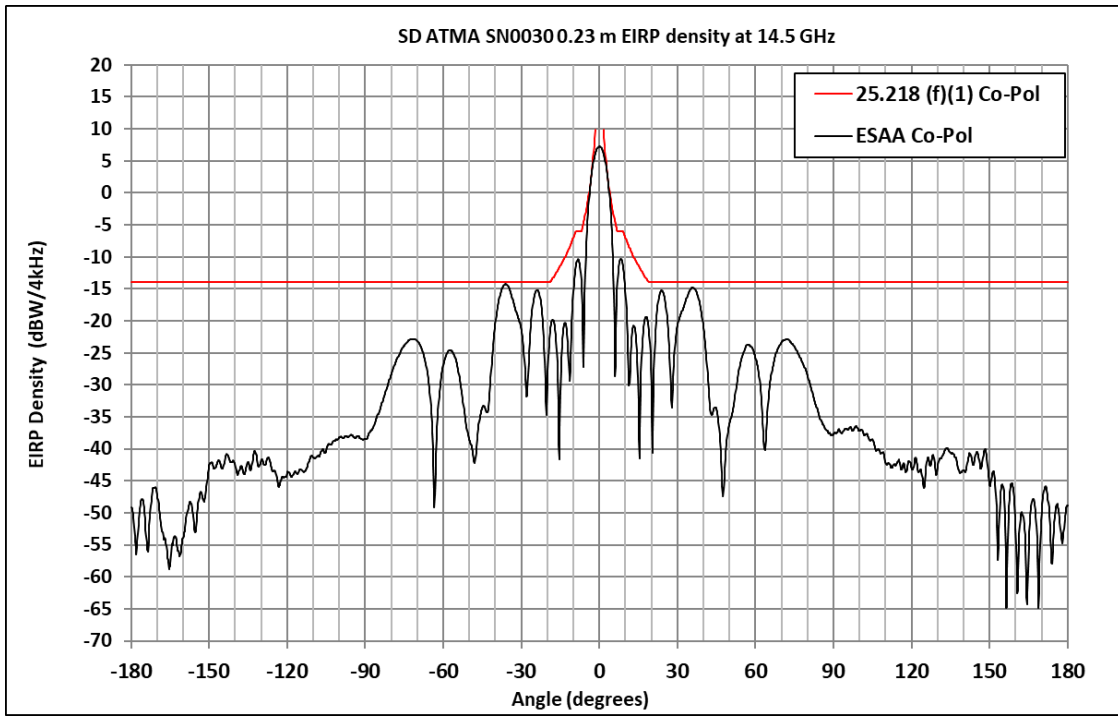


(iv-v) Cross-Pol EIRP density in the plane tangent and perpendicular to the GSO arc

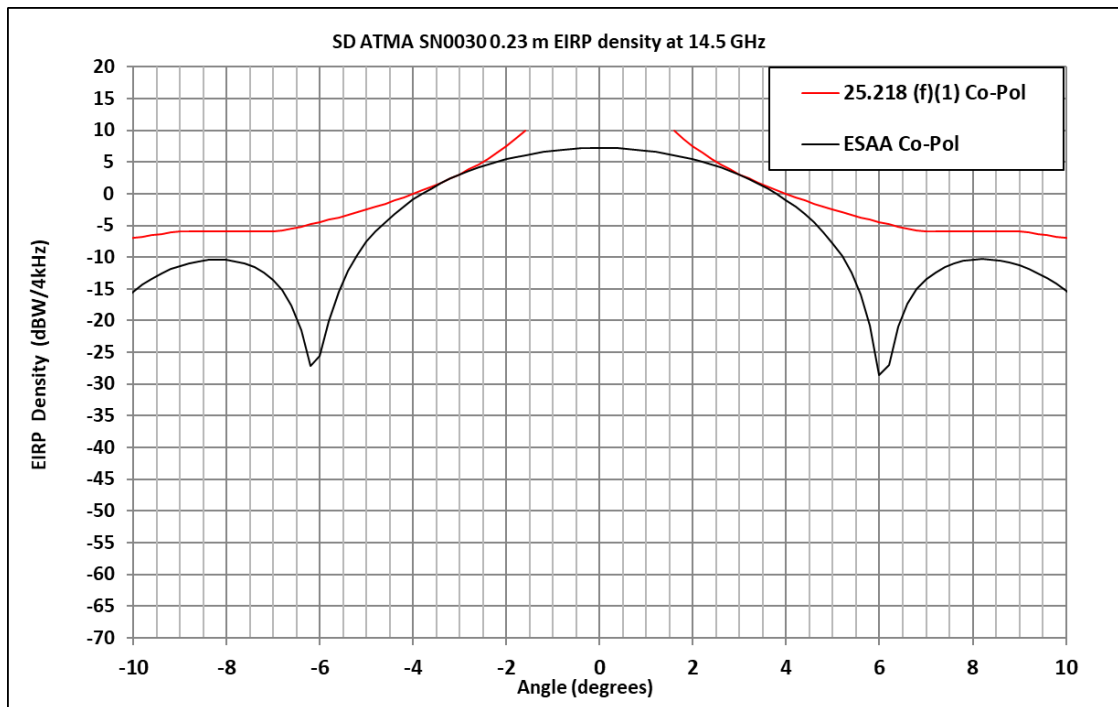


EIRP density plots (14.5 GHz, peak EIRP/density: 7.2 dBW/ 4KHz)

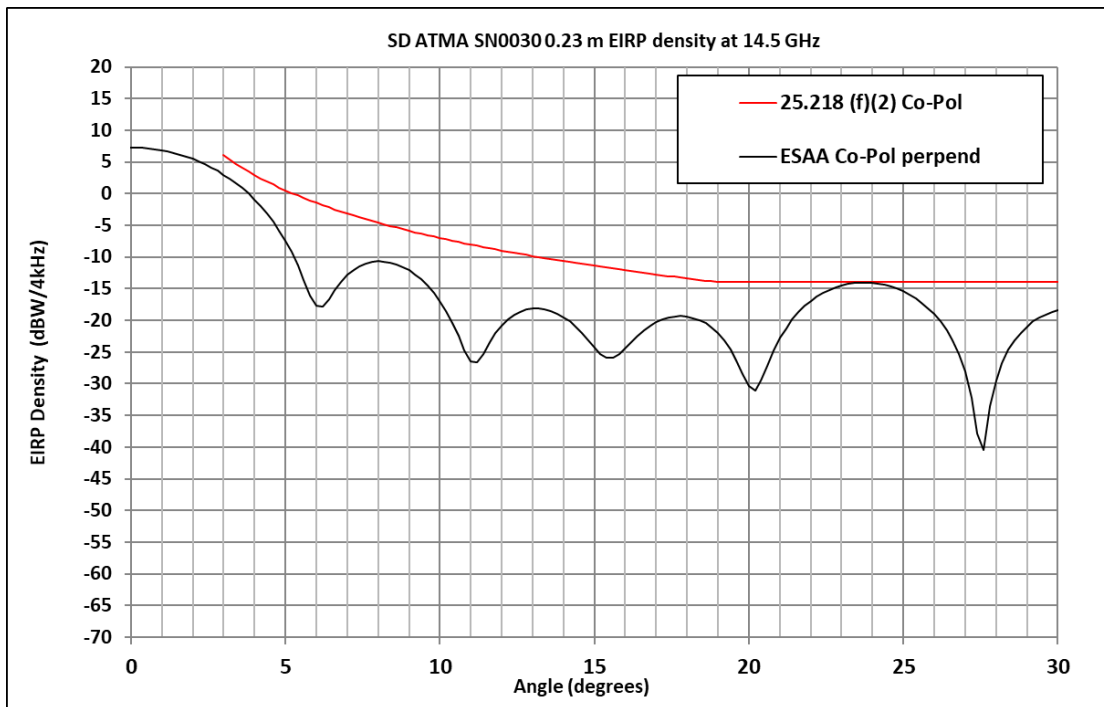
(i) Co-Pol EIRP density in the plane tangent to the GSO



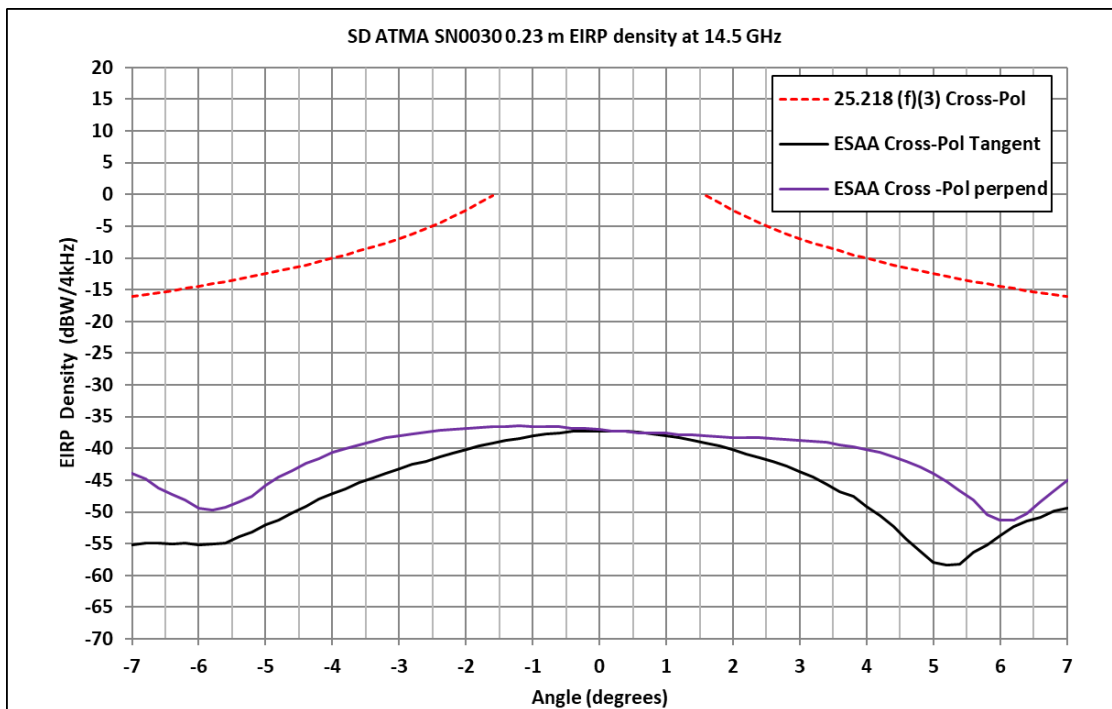
(ii) Co-Pol EIRP density in the plane tangent to the GSO



(iii) Co-Pol EIRP density in the plane perpendicular to the GSO arc



(iv-v) Cross-Pol EIRP density in the plane tangent and perpendicular to the GSO arc



V. Matrix of Compliance for §25.228

Rule	Text	Citation
§25.228 (a)	GSO FSS ESIM transmissions must comport with the applicable EIRP density limits in §25.218, unless coordinated pursuant to the requirements in §25.220	Intelsat complies with the applicable EIRP density limits in §25.218 as shown above.
§25.228 (b)	Each FSS ESIM must be self-monitoring and, should a condition occur that would cause the ESIMs to exceed its authorized off-axis EIRP density limits in the case of GSO FSS ESIMs or any emission limits included in the licensing conditions in the case of NGSO FSS ESIMs, the ESIM must automatically cease transmissions within 100 milliseconds, and not resume transmissions until the condition that caused the ESIM to exceed those limits is corrected.	Intelsat agrees to comply
§25.228 (c)	Each FSS ESIM must be monitored and controlled by a network control and monitoring center (NCCM) or equivalent facility. Each ESIM must comply with a “disable transmission” command from the NCCM within 100 milliseconds of receiving the command. In addition, the NCCM must monitor the operation of each ESIM in its network, and transmit a “disable transmission” command to any ESIM that operates in such a way as to exceed the authorized off-axis EIRP density limit for GSO FSS ESIMs or any emission limits included in the licensing conditions in the case of NGSO FSS ESIMs. The NCCM must not allow the ESIM(s) under its control to resume transmissions until the condition that caused the ESIM(s) to exceed the authorized EIRP density limits is corrected.	Intelsat agrees to comply
§25.228 (g)(1)	There must be a point of contact in the United States, with phone number and address, available 24 hours a day, seven days a week, with authority and ability to cease all emissions from the ESAAAs.	<p>Intelsat agrees to maintain the following point of contact available 24 hours per day, seven days per week</p> <p>ISOC – Intelsat Secure Operating Center Phone: +1 (404) 381-2727 / Email: ISOC@intelsatgeneral.com</p> <p>Primary Point of Contact: Angela Wheeler, Manager, Network Operations Phone: +1 (404) 381-2727 Email: Angela.Wheeler@IntelsatGeneral.com</p>

§25.228 (g)(2)	All ESAA terminals operated in U.S. airspace, whether on U.S.-registered civil aircraft or non-U.S.-registered civil aircraft, must be licensed by the Commission. All ESAA terminals on U.S.-registered civil aircraft operating outside of U.S. airspace must be licensed by the Commission, except as provided by section 303(t) of the Communications Act.	Intelsat agrees to comply												
§25.228 (g)(3)	Prior to operations within a foreign nation's airspace, the ESAA operator must ascertain whether the relevant administration has operations that could be affected by ESAA terminals and must determine whether that administration has adopted specific requirements concerning ESAA operations. When the aircraft enters foreign airspace, the ESAA terminal must operate under the Commission's rules, or those of the foreign administration, whichever is more constraining. To the extent that all relevant administrations have identified geographic areas from which ESAA operations would not affect their radio operations, ESAA operators may operate within those identified areas without further action. To the extent that the foreign administration has not adopted requirements regarding ESAA operations, ESAA operators must coordinate their operations with any potentially affected operations.	Intelsat agrees to comply												
§25.228 (i)	<p>For ESAA transmissions in the 14.0-14.5 GHz band from international airspace within line-of-sight of the territory of a foreign administration where fixed service networks have primary allocation in this band, the maximum power flux density (pfd) produced at the surface of the Earth by emissions from a single aircraft carrying an ESAA terminal must not exceed the following values unless the foreign Administration has imposed other conditions for protecting its fixed service stations:</p> <table border="1" data-bbox="272 1465 1031 1624"> <tr> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>-132 + 0.5 · θ</td> <td>dB(W/(m² · MHz))</td> <td>For</td> <td>$\theta \leq 40^\circ$.</td> </tr> <tr> <td>-112</td> <td>dB(W/(m² · MHz))</td> <td>For</td> <td>$40^\circ < \theta \leq 90^\circ$.</td> </tr> </table> <p>Where: θ is the angle of arrival of the radio-frequency wave (degrees above the horizontal) and the aforementioned limits relate to the pfd under free-space propagation conditions.</p>					-132 + 0.5 · θ	dB(W/(m ² · MHz))	For	$\theta \leq 40^\circ$.	-112	dB(W/(m ² · MHz))	For	$40^\circ < \theta \leq 90^\circ$.	Intelsat agrees to comply with the levels
-132 + 0.5 · θ	dB(W/(m ² · MHz))	For	$\theta \leq 40^\circ$.											
-112	dB(W/(m ² · MHz))	For	$40^\circ < \theta \leq 90^\circ$.											
§25.228 (j)(1)	Operations of ESIMs in the 14.0-14.2 GHz (Earth-to-space) frequency band within 125 km (for ESVs and VMESs) or within radio line of sight (for ESAAs) of the NASA TDRSS facilities on Guam (latitude 13°36'55" N, longitude 144°51'22" E), White Sands, New Mexico (latitude 32°20'59" N, longitude	Intelsat agrees that the ESAA operations will be pursuant to the coordination agreement with NASA												

	<p>106°36'31" W and latitude 32°32'40" N, longitude 106°36'48" W), or Blossom Point, Maryland (latitude 38°25'44" N, longitude 77°05'02" W) are subject to coordination with the National Aeronautics and Space Administration (NASA) through the National Telecommunications and Information Administration (NTIA) Interdepartmental Radio Advisory Committee (IRAC). Licensees must notify the International Bureau once they have completed coordination. Upon receipt of such notification from a licensee, the International Bureau will issue a public notice stating that the licensee may commence operations within the coordination zone in 30 days if no party has opposed the operations. When NTIA seeks to provide similar protection to future TDRSS sites that have been coordinated through the IRAC Frequency Assignment Subcommittee process, NTIA will notify the Commission's International Bureau that the site is nearing operational status. Upon public notice from the International Bureau, all Ku-band ESIM licensees must cease operations in the 14.0-14.2 GHz band within 125 km (for ESVs and VMESs) or within radio line of sight (for ESAAs) of the new TDRSS site until the licensees complete coordination with NTIA/IRAC for the new TDRSS facility. Licensees must notify the International Bureau once they have completed coordination for the new TDRSS site. Upon receipt of such notification from a licensee, the International Bureau will issue a public notice stating that the licensee may commence operations within the coordination zone in 30 days if no party has opposed the operations. The ESIM licensee then will be permitted to commence operations in the 14.0-14.2 GHz band within 125 km (for ESVs and VMESs) or within radio line of sight (for ESAAs) of the new TDRSS site, subject to any operational constraints developed in the coordination process</p>	
<p>§25.228 (j)(2)</p>	<p>Within 125 km (for ESVs and VMESs) or within radio line of sight (for ESAAs) of the NASA TDRSS facilities identified in paragraph (j)(1) of this section, ESIM transmissions in the 14.0-14.2 GHz (Earth-to-space) band shall not exceed an EIRP spectral density towards the horizon of 12.5 dBW/MHz, and shall not exceed an EIRP towards the horizon of 16.3 dBW.</p>	<p>Intelsat agrees that the ESAA operations will be pursuant to the coordination agreement with NASA</p>
<p>§25.228 (j)(3)</p>	<p>Operations of ESIMs in the 14.47-14.5 GHz (Earth-to-space) frequency band in the vicinity (for ESVs and VMESs) or within radio line of sight (for ESAAs) of radio astronomy service (RAS) observatories observing in the 14.47-14.5 GHz band are subject to coordination with the National Science Foundation (NSF). The appropriate NSF contact point to initiate coordination is Electromagnetic Spectrum Management Unit, NSF, Division of Astronomical Sciences, 2415 Eisenhower Avenue, Arlington VA 22314; Email: <i>esm@nsf.gov</i>. Licensees must notify the International Bureau once they have completed coordination. Upon receipt of the coordination agreement from a licensee, the International Bureau will issue a public notice</p>	<p>Intelsat agrees to comply</p>

	stating that the licensee may commence operations within the coordination zone in 30 days if no party has opposed the operations. Table 1 provides a list of each applicable RAS site, its location, and the applicable coordination zone.	
§25.228 (j)(4)	When NTIA seeks to provide similar protection to future RAS sites that have been coordinated through the IRAC Frequency Assignment Subcommittee process, NTIA will notify the Commission's International Bureau that the site is nearing operational status. Upon public notice from the International Bureau, all Ku-band ESIMs licensees must cease operations in the 14.47-14.5 GHz band within the relevant geographic zone (160 kms for single-dish radio observatories and Very Large Array antenna systems and 50 kms for Very Long Baseline Array antenna systems for ESVs and VMESs, radio line of sight for ESAAs) of the new RAS site until the licensees complete coordination for the new RAS facility. Licensees must notify the International Bureau once they have completed coordination for the new RAS site and must submit the coordination agreement to the Commission. Upon receipt of such notification from a licensee, the International Bureau will issue a public notice stating that the licensee may commence operations within the coordination zone in 30 days if no party opposed the operations. The ESIMs licensee then will be permitted to commence operations in the 14.47-14.5 GHz band within the relevant coordination distance around the new RAS site, subject to any operational constraints developed in the coordination process.	Intelsat agrees to comply
§25.228 (j)(5)	ESIMs licensees must use Global Positioning Satellite-related or other similar position location technology to ensure compliance with the provisions of subparagraphs 1-3 of this paragraph.	Intelsat agrees to comply