

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington D.C. 20554**

In the Matter of
HISPAMAR SATELITES, S.A. (HISPAMAR)

File N° _____

Petition for Declaratory Ruling to Add
AMAZONAS NEXUS Satellite nominally at 61° W L
to the Commission's Permitted Space Stations List
for the Ku and Ka bands; and

Petition for Declaratory Ruling to Serve
U.S. Market Using the Extended Ku-band 13.75-14.0 GHz
/10.7 – 11.45 GHz and non conventional Ka-band 27.5 –
28.35 / 17.8 – 18.3 GHz Capacity on AMAZONAS NEXUS

To: International Bureau

Petition

Hisparmar Satélites, S.A. ("Hisparmar") hereby respectfully requests that the Commission authorize the Amazonas Nexus Ku-band and Ka-band spacecraft to serve the U.S. market from 61.0° W.L. At that location, the spacecraft will replace Amazonas-2 (S2793)¹ and will supplement the service being provided by the Amazonas-3 (S2886)² C-band, Ku-band and Ka-band spacecraft at 61.0° W.L. Specifically, Hisparmar requests that the Commission:

1) add Amazonas Nexus to the Commission's Permitted Space Station List ("Permitted List") for fixed-satellite service ("FSS") in conventional Ku-band spectrum, 11.7 – 12.2 GHz; 14.0 – 14.5 and in parts of the conventional Ka-band spectrum 18.3 – 18.8 GHz; 28.35 – 28.6 GHz.

2) permit U.S. earth stations to communicate with Amazonas Nexus Ku-band capacity in the 10.7 – 11.45 GHz ; 13.75 – 14.0 GHz and in the Ka-band capacity in the 17.8-18.3 GHz³; 27.5-28.35 GHz;

Grant of the requested authority is consistent with Commission precedent and will serve the public interest by allowing Hisparmar to expand its services at the nominal 61° W.L. orbital location.

A completed FCC Form 312 is attached, along with technical materials on Schedule S and in narrative form pursuant to Section 25.114 of the Commission's rules. Amazonas Nexus is

¹ See *Hisparmar's Applications for add AMAZONAS-2 Satellite in the Commission's Permitted List*, File No. SAT-PPL-20090806-00081 and SAT-PPL-20100506-00093

² See *Hisparmar's Applications for add AMAZONAS-3 Satellite in the Commission's Permitted List*, File No. SAT-PPL-20121018-00183

³ Hisparmar is aware that the band 17800-18300 MHz is primary for FS and secondary for FSS. See 47 C.F.R. § 2.106, US334.

scheduled for launch in the end of 2022 and entry into service during the second quarter of 2023. Amazonas Nexus will be co-located with Amazonas-2 until the final lifetime of it. Hispamar seeks action on this petition consistent with that schedule.

BACKGROUND

Amazonas Nexus represents the next step in Hispamar’s network of high-throughput satellites to support high data rate fixed and mobile services. Designed and being manufactured by Thales Alenia Space, Amazonas Nexus will include a powerful Digital Transparent Processor, which will allow Hispamar to offer customers extraordinary efficiency and unrivalled flexibility in bandwidth management capabilities. Equipped with a combination of wide beams and multiple user spot beams, the fully digital satellite will provide mobility customers in particular with an unsurpassed ability to efficiently and flexibly modify their networks in real time in response to changing bandwidth demands.

The table below identifies the frequencies that will be used for each of the beam types.

Direction	Frequency Range	Type of beam
Earth-to-space	14 – 14.25 GHz	Ku Wide Beam
Space-to-Earth	11.7 – 11.95 GHz	Ku Wide Beam
Earth-to-space	13.75 – 14.036 and 14.214 – 14.5 GHz	Ku User Spot Beams
Space-to-Earth	10.7 – 11.45 and 11.95 – 12.2 GHz	Ku User Spot Beams
Earth-to-space	27.5 – 28.6 GHz	Ka GW Spot Beams
Space-to-Earth	17.85 – 18.8 GHz	Ka GW Spot Beams

The Amazonas Nexus frequencies will operate under the following ITU filings submitted by the Administration of Brazil:

- B-SAT-Q: Ku non planned bands
- B-SAT-1Q: Ka band
- B-SAT-61W: Ku non planned bands and Ka band

The Amazonas Nexus frequencies will operate under the following ITU filings submitted by the Administration of France:

- F-SAT-E-30B-61W: Appendix 30B Ku FSS planned bands

PETITION FOR DECLARATORY RULING

I Amazonas Nexus Meets the Requirements for Inclusion on the Permitted Space Station List.

In the *DISCO II* proceeding, the Commission adopted a framework for determining whether to permit foreign-licensed satellites to serve the U.S. market, and these standards are codified in Section 25.137 of the Commission’s Rules.⁴ The Commission’s policies are intended to ensure that entry by a foreign-licensed satellite will not distort competition in the United

⁴ 47 C.F.R. § 25.137.

States.⁵ The Commission also considers whether there are spectrum availability issues or concerns relating to national security, law enforcement, foreign policy, or trade that would present an obstacle to U.S. market access.⁶ Hispamar's market access requests for Amazonas Nexus – to add Amazonas Nexus to the Permitted List for FSS in the conventional Ku-band and in the conventional Ka-band, and to authorize use of other spectrum available on the satellite for FSS– fully comply with Commission requirements.

Furthermore, this petition includes all the information required under Sections 25.114 and 25.137 and other relevant parts of the Commission's rules. Accordingly, Hispamar urges the Commission to grant the instant petition and include Amazonas Nexus on the Permitted Space Stations List and to authorize use of other spectrum available on the satellite for FSS.

Section 25.137(a). Section 25.137(a) requires that petitioners seeking to operate with a non-US licensed space station submit as an exhibit to their Form 312 applications a showing demonstrating that U.S.-licensed satellite systems have effective competitive opportunities to provide analogous services in the country in which the non-U.S. licensed space station is licensed, and all countries in which communications with the US earth station will originate and terminate.

Section 25.137(b). Section 25.137(b) also requires petitioners to submit as exhibits to their Form 312 applications essentially the same legal, technical and financial information required of applicants seeking space station authorizations from the Commission in accordance with Part 25 of the Commission's rules.

Section 25.114(a). Section 25.114(a) requires that petitioners seeking space station authorization must submit a comprehensive proposal for each proposed space station on FCC Form 312, Main form and Schedule S, together with attached exhibits as described in paragraph (d) of this Section. These are attached to this Petition. The Schedule S is fulfilled for the frequency bands requested over USA territory.

Sections 25.114(c) and (d). Information required under these paragraphs is also attached to this Petition.

Waiver Requests

Hispamar requests that the Commission grant some waivers of this requirement pursuant to Section 1.3 of the Commission's rules:

- Hispamar requests waiver of Section 2.106 Footnote NG52, which permit the use of the 13000-13250 / 10700-11700 MHz frequency bands by non-federal fixed satellite service for international systems only⁷;

Amazonas Nexus will utilize the 10700 - 11450 MHz frequency bands to provide service to U.S. territory and requests a waiver to allow use of these bands for domestic service use on a non-interference, non-protected basis.

Good cause for a waiver exists in this case. Grant of the requested waiver to permit

⁵ *DISCO II* at ¶ 7.

⁶ *See id.* at ¶ 178.

⁷ 47 C.F.R. §2.106 footnote NG52

domestic use of these frequencies would be consistent with some precedent⁸. As in those cases, grant of the requested waiver will make available additional domestic capacity without risk of harmful interference because Amazonas Nexus will operate on a non-interference, non-protected basis.

Hispamar also agrees to abide by the customer notification requirements that the International Bureau has previously imposed when granting waivers of NG52.⁹ Hispamar will inform its customers in writing, including any customers receiving end-user services from resellers accessing capacity on Amazonas Nexus, of the potential for interference from FS operations in the 10700-11700 MHz band.

- Hispamar requests a partial waiver of Part 25.210(f). Due to satellite design constraints, this satellite did not have enough capacity to be equipped with frequency reuse for some frequencies in some Ku band spots of the United States.
- It is also required that each application must also contain the formal waiver required by section 304 of the Communications Act, 47 U.S.C. 304. Such formal waiver is hereby formally requested.

II Competition considerations

The Amazonas Nexus satellite is owned by HISPASAT CANARIAS - a company owned one hundred per cent by HISPASAT, S.A. and operated by HISPAMAR SATÉLITES, which is based in Brazil. The Commission concluded in DISCO II¹⁰ that, in order to be granted access to the U.S. market, space station operators not licensed by the Commission will be required to meet the same qualification that U.S.-licensed space station operators must meet to obtain a satellite license. The information provided in this Petition, including the associated attachments and FCC Form 312, demonstrate that Hispamar satisfies these requirements.

In its DISCO II Order¹¹, the Commission “*adopt[s] a presumption that entry by WTO Member satellite systems will promote competition in the U.S. satellite services market*”. In this context, Hispamar, like an operator licensed by Brazil, a Member of WTO, believes that serves the pro-competitive goals of Section 25.137 in order to be included on the Permitted Space Station list and to be authorized to use other spectrum available on the satellite for FSS.

III Financial requirements

In its *First Space Station Licensing Reform Order*, the Commission eliminated the financial requirements then in place and replaced them with a bond requirement¹². According to 47 C.F.R 25.165, bond will be posted, if any, in duly time.

⁸ For example, see Policy Branch Information; Actions Taken, Report No. SAT-00796, File No. SAT LOA-20101014-00219 (July 29, 2011) (granting waiver of Footnote 2 of Section 25.202(a)(1) and Footnote NG104 of Section 2.106 for Intelsat 18)

⁹ See, e.g., *id.*; *Hispatat for Waiver*, Stamp Grant, File No. S SAT-PPL-20160722-00064, Condition 6.b (June. 04, 2017);

¹⁰ See DISCO II §§ 154-59

¹¹ See DISCO II, §7

¹² *First Space Licensing Reform Order*, 18 FCC Rcd at 10826 (para. 170)

IV Spectrum Availability

The Commission considers spectrum availability as a factor in determining whether to allow a foreign-licensed satellite to serve U.S. market and evaluates if access will create the potential for harmful interference with U.S.-licensed satellites. As it is said above, Amazonas Nexus will operate over USA conventional Ku, frequencies currently in operation on Amazonas-2 and Amazonas-3 which was previously granted. In addition, it will also operate new frequency bands over USA:

- part of the extended Ku-band frequencies: 10.95 – 11.2 GHz and 13.75-14.0 GHz
- part of the Ku Appendix 30B frequencies: 10.7 – 10.95 and 11.2 – 11.45 GHz
- part of the conventional Ka band: 28.35 – 28.6 GHz / 18.3 – 18.8 GHz
- part of the non conventional Ka band: 27.5 – 28.35 GHz / 17.8 – 18.3 GHz

There is no satellite, other than Amazonas-2 and Amazonas-3 (both operated by Hispamar), serving U.S. market currently located or proposed to be located at 61°W.L. orbital location that uses or proposes to use these frequency bands. Accordingly, the frequencies are available for use in the provision of service to the United States.

V Access to the US Market for Amazonas Nexus will Serve the Public Interest

Access by all U.S. earth stations with an ALSAT designation and through the 10.7 – 11.45 GHz, 13.75-14.0 GHz, 17.8 – 18.3 GHz and 27.5 – 28.35 GHz bands to Amazonas Nexus would produce substantial public interest benefits. The availability of Hispamar space segment to the U.S. Fixed-Satellite Service market will continue to stimulate lower prices, improve service quality, increase service options and foster technological innovation.

VI Conclusion

Therefore, for the reasons set out above, Hispamar respectfully requests that the Commission issue a declaratory ruling adding the Amazonas Nexus satellite nominally at 61°W.L. to the Ku Permitted Space Station List and to the Ka Permitted Space Station List and permitting the use of the 10.7 – 11.45 GHz, 13.75 - 14.0 GHz, 17.8 – 18.3 GHz and 27.5 – 28.35 GHz capacity on the Amazonas Nexus satellite as well.

Respectfully submitted,
Hispamar Satélites, S.A.

By: ___/s/_____

Cristina García de Miguel

Manager, Orbital-Spectrum Resources and Regulatory Affairs

TECHNICAL ANNEX

1. Introduction

This technical annex is submitted in support of the Amazonas Nexus petition for U.S. market access for the Amazonas Nexus spacecraft to be located at 61.0° W.L. Amazonas Nexus will replace Amazonas-2, currently operating at 61.0° W.L. The characteristics of the Amazonas Nexus spacecraft, as well as its compliance with the various provisions of Part 25 of the Federal Communications Commission’s (“FCC or “Commission”) rules, are provided in the remainder of this Technical Annex.

2. Spacecraft Overview

The Amazonas Nexus satellite is currently under construction by Thales Alenia Space, and is designed to operate in the Ku-band (wide beams and user spot beams) using Horizontal and Vertical polarizations and in the Ka band (GW spot beams) using both right- and left-hand circular polarizations (RHCP, LHCP). It also operates in C band Appendix 30B frequency band, but Hispamar is not requesting permission to operate this band in USA in this application. Amazonas Nexus will provide coverage of North, Central and South America as well as the Caribbean and the Atlantic Ocean using multiple user spot beams that will provide flexible high-throughput satellite (HTS) capability using Digital Transparent Processor (DTP) technology that will be fed by Gateways operating in Ka band, 4 of them located in US territory. The flexibility enabled by the DTP makes it possible to dedicate various amounts of bandwidth and RF power to each Amazonas Nexus beam within the frequency plan based on customer demand and business requirements. The satellite will serve a variety of broadband markets, including fixed data, aeronautical and maritime customers. This application seeks authority for Amazonas Nexus to provide wide beam and multi-beam coverage of USA territories in North America and the Caribbean in the following frequency ranges:

Direction	Frequency Range	Type of beam
Earth-to-space	14 – 14.25 GHz	Ku Wide Beam
Space-to-Earth	11.7 – 11.95 GHz	Ku Wide Beam
Earth-to-space	13.75 – 14.036 and 14.214 – 14.5 GHz	Ku User Spot Beams
Space-to-Earth	10.7 – 11.45 and 11.95 – 12.2 GHz	Ku User Spot Beams
Earth-to-space	27.5 – 28.6 GHz	Ka GW Spot Beams
Space-to-Earth	17.85 – 18.8 GHz	Ka GW Spot Beams

3. Antenna beams

The Schedule S online information is submitted as part of this filing. Due to the large numbers of identical fixed spot beams, the predicted antenna gain contours and associated performance characteristics for one representative beam of each type, has been incorporated in the schedules as indicated below:

User Spot Beams¹³

- Type US1H: Receiving spot beam in H polarization. Beam size 1.3°.

¹³ Note that there are mainly two types of user spot beams with differences in the beam size; 1.3° and 1.8°.

- Type US1V: Receiving spot beam in V polarization. Beam size 1.3°.
- Type US2H: Transmitting spot beam in H polarization. Beam size 1.3°.
- Type US2V: Transmitting spot beam in V polarization. Beam size 1.3°.
- Type US3H: Receiving spot beam in H polarization. Beam size 1.8°.
- Type US3V: Receiving spot beam in V polarization. Beam size 1.8°.
- Type US4V: Transmitting spot beam in V polarization. Beam size 1.8°.
- Type US4H: Transmitting spot beam in H polarization. Beam size 1.8°.

GW Spot Beams

- Type GW1R: Receiving spot beam in RHCP polarization.
- Type GW1L: Receiving spot beam in LHCP polarization.
- Type GW2R: Transmitting spot beam in RHCP polarization.
- Type GW2L: Transmitting spot beam in LHCP polarization.

Annex A provides the maximum antenna boresight gain point latitude and longitudes, rounded to the nearest 0.1 degree, of each identical fixed spot beam within each beam group described in Schedule S as specified by Section 25.114(c)(4)(vii)(B).

4. Telemetry, Telecommand and Control (TT&C) frequencies

The Telemetry, Telecommand and Control (TT&C) operations will be provided by earth stations located out of the United States more specifically in Brazil and Spain. The TT&C frequencies are flexible with a tuneable range from 11.70-12.45 GHz for Telemetry and 13.75-14.5 GHz for Telecommand operations. The TC polarization is also flexible and can be selected between H and V. In practice, a single center frequency with a nominal operational bandwidth will be used. On-station TT&C transmissions will occur in the Ku-band utilizing the following frequencies:

Telecommand:

- F1= 13752.0 MHz (V)
- F2= 14498.5 MHz (H)

Telemetry:

- F1=11704.5MHz (V)
- F2= 12198.0 MHz (H)

Beacon:

- F1= 17852.148438 (RHCP)
- F2= 17852.148438 (LHCP)

5. Regulatory considerations

5.1. Operations in the conventional and extended Ku band

Interference Analysis and Certifications Pursuant to §25.140

The downlink EIRP density of Amazonas Nexus transmissions in the conventional Ku-band (11.7 – 12.2 GHz) and in the extended Ku-band (10.95 – 11.2 GHz) will not exceed 14 dBW/4kHz for digital transmissions or 17 dBW/4kHz for analog transmissions, unless operation is coordinated with operators of authorized co-frequency space stations at assigned

locations within six degrees of Amazonas Nexus at 61° W.L.as specified in Section 25.140(a)(3)(ii).

The power flux density limits for space stations operating in the 10.95 – 11.2 GHz band are specified in Section 25.208. As provided in Schedule S, the Amazonas Nexus transmissions do not exceed these limits.

The Commission’s rules do not specify a PFD Limits in the 11.7 – 12.2 GHz. However, there are PFD limits specified in rule No. 21.16 of the ITU Radio Regulations. Amazonas Nexus will not exceed these limits.

The uplink transmissions in the conventional Ku-band (14 – 14.5 GHz) and in the extended Ku-band (13.75 – 14 GHz) will not exceed applicable EIRP density envelopes in Sections 25.218 unless the non-routine uplink operation is coordinated with operators of authorized co-frequency space stations at assigned locations within six degrees of Amazonas Nexus at 61° W.L.

Regulatory considerations

Operations in the 10.95 – 11.2 GHz frequency band shall comply with the terms of footnote US211 to the United States Table of Frequency Allocations, 47 C.F.R. §2.106, US211, which urges applicants for airborne or space station assignments to take all practicable steps to protect radio astronomy observations in the adjacent bands from harmful interference.

For operations in the 13750-14000 MHz band, Hispamar accepts the following conditions:

- In the 13750-14000 MHz band (Earth-to-space), receiving space stations in the fixed-satellite service shall not claim protection from radiolocation transmitting stations operating in accordance with the United States Table of Frequency Allocations.
- Pursuant to footnote US337 of the United States Table of Frequency Allocations, 47 C.F.R. § 2.106, any earth station in the United States and its possessions communicating with the Amazonas Nexus space station in the 13750-13800 MHz band (Earth-to-space) is required to coordinate through National Telecommunications and Information Administration’s (“NTIA”) Interdepartment Radio Advisory Committee’s (“IRAC”) Frequency Assignment Subcommittee (“FAS”) to minimize interference to the National Aeronautics and Space Administration Tracking and Data Relay Satellite System, including manned space flight.
- Operations of any earth station in the United States and its possessions communicating with the Amazonas Nexus space station in the 13750-14000 MHz band (Earth-to-space) shall comply with footnote US356 of United States Table of Frequency Allocations, 47 C.F.R. § 2.106, US356, which specifies a mandatory minimum antenna diameter of 4.5 meters and a non-mandatory minimum and maximum equivalent isotropically radiated powers (“e.i.r.p.”).
- Operators of earth stations accessing the Amazonas Nexus space station in the 13750-14000 MHz band are encouraged to cooperate voluntarily with NASA in order to facilitate continued operation of NASA's Tropical Rainfall Measuring Mission (“TRMM”) satellite.

5.2. Operations in the Ku Appendix 30B band

Interference Analysis and Certifications Pursuant to §25.140

With respect to proposed operation in the 10700-10950 MHz (space-to-Earth), 11200 - 11450 MHz (space-to-Earth), the proposed operation takes into account the applicable requirements of Appendix 30B of the ITU Radio Regulations. Further, compatibility with U.S. ITU filings under Appendix 30B is assured since there are no other existing U.S. ITU Filings under Appendix 30B within at least 10° of 61° W.L. When the Part A of F-SAT-E-30B-61W¹⁴ Appendix 30B satellite network was published¹⁵, only one U.S. satellite network was identified as potentially affected according to App.30B, Art.6, § 6.5 - Annex 4, however this satellite network has been suppressed¹⁶.

The Commission's rules do not specify a PFD Limits in the 10.7 – 10.95 GHz and 11.2 – 11.45 GHz bands. However, there are PFD limits specified in rule No. 21.16 of the ITU Radio Regulations. Amazonas Nexus will not exceed these limits.

The only authorized satellite in these frequency bands at ± 10° of orbital separation from 61° W.L. is EUTELSAT 65 WEST A. The coordination with respect to this satellite was successfully concluded and Amazonas Nexus will be operated in accordance to this agreement.

Regulatory considerations

Operations in the 10.7 – 10.95 GHz and 11.2 – 11.45 GHz frequency band shall comply with the terms of footnote US211 to the United States Table of Frequency Allocations, 47 C.F.R. §2.106, US211, which urges applicants for airborne or space station assignments to take all practicable steps to protect radio astronomy observations in the adjacent bands from harmful interference.

5.3. Operations in the Ka band

Interference Analysis and Certifications Pursuant to §25.140

PFD at the Earth's surface produced by emissions from Amazonas Nexus in the conventional Ka-band, 18.3-18.8 GHz, and in the other part of the Ka band 17.85 – 18.3 GHz, including clear sky, and for all methods of modulation will not exceed a level of -118 dBW/m²/MHz.

The power flux density limits for space stations operating in the 17.85 – 18.8 GHz band are specified in Section 25.208. As provided in Schedule S, the Amazonas Nexus transmissions do not exceed these limits.

¹⁴ F-SAT-E-30B-61W is the ITU satellite network under which Amazonas Nexus operates the Appendix 30B frequency bands.

¹⁵ See F-SAT-E-30B-61W AP30B/A6A 198 ITU special section published in BR IFIC 2713 on 21/02/2012

¹⁶ See USASAT 26G AP30B/A6A 198 ITU special section published in BR IFIC 2943 on 06/04/2021 confirming the suppression of the network.

The associated uplink transmissions, 27.5 – 28.6 GHz will not exceed applicable EIRP density envelopes in Section 25.218 for the conventional Ka-band (28.35 – 28.6 GHz) and for the non conventional Ka band (27.5 – 28.35 GHz), unless the non-routine operation is coordinated with operators of authorized co-frequency space stations at assigned locations within six degrees of Amazonas Nexus at 61° W.L.

In the 27.5 – 28.35 / 17.85 – 18.3 GHz:

- at 63°W, orbital position separated by two degrees of 61°W (West), the satellite Telstar 19V is already authorized. The coordination with respect to this satellite was successfully concluded and Amazonas Nexus will be operated in accordance to this agreement.
- At 59°W, orbital position separated two degrees away from 61°W (East), because there are no previously authorized co-frequency space stations at this location, Annex B provides an interference analysis demonstrating compatibility with a hypothetical co-frequency space station two degrees away with the same receiving and transmitting characteristics as the proposed space station, as required by Section 25.140(a)(3)(vi).

Regulatory considerations

In the 27.5 – 28.35 GHz Hispamar or the associated Gateway operator, will seek authority to operate the gateways communicating with Amazonas Nexus on a protected basis pursuant to Section 25.136(a)(4). The information required to demonstrate compliance with Section 25.136 will be submitted with the gateway earth station applications. Applications for any other earth stations seeking to communicate with Amazonas Nexus on a protected basis in these frequencies will provide the information required under Section 25.136(a)(4).

6. Emission Compliance

Section 25.202(e) requires that the carrier frequency of each space station transmitter be maintained within 0.002% of the reference frequency. Amazonas Nexus is designed to be compliant with the provisions of this rule.

Amazonas Nexus will comply with the provisions of Section 25.202(f) with regard to its emissions.

7. Orbital Debris Mitigation Plan

Spacecraft Hardware Design

AMAZONAS NEXUS is designed such that no debris will be released during normal operations. To that extent, Hispamar has assessed and limited the amount of debris that will be released in a planned manner during normal operations of AMAZONAS NEXUS:

- During the satellite ascent, after separation from the launcher, no debris will be generated.
- All deployments will be conducted using pyrotechnic devices designed to retain all physical debris.

- No debris is generated during normal on-station operations, and the spacecraft will be in a stable configuration.

Hispamar has also assessed and limited the probability of the spacecraft becoming a source of orbital debris by collisions with small debris or meteoroids that could cause loss of control and prevent post-mission disposal. The design of the spacecraft locates all sources of stored energy within the body of the structure, which provides protection from small orbital debris.

Hispamar requires that the spacecraft manufacturer assesses the probability of micrometeorite damage that can cause any loss of functionality. Hispamar has taken the following steps to limit the effects of such collisions:

- (1) critical spacecraft components are located inside the protective body of the spacecraft and properly shielded; and
- (2) all spacecraft subsystems have redundant components to ensure no single-point failures.

The spacecraft will not use any subsystems for end-of-life disposal that are not used for normal operations.

Minimizing accidental explosions

Hispamar has assessed and limited the probability of accidental explosions during and after completion of mission operations.

The design of the AMAZONAS NEXUS spacecraft is such that the risk of explosion is minimized both during and after mission operations. In designing and building the spacecraft, the manufacturer is taking steps to ensure that debris generation will not result from the conversion of energy sources on board the satellite into energy that fragments the satellite. Burst tests are performed on all pressure vessels during qualification testing to demonstrate a margin of safety against burst. Propellant tanks and thrusters are isolated using redundant valves and electrical power systems are shielded in accordance with standard industry practices.

At the end of operational life, after the satellite has reached its final disposal orbit, Hispamar will ensure the removal of all stored energy on the spacecraft by depleting all propellant tanks, venting all pressurized systems and by leaving the batteries discharged.

Safe Flight Profiles

Hispamar has assessed and limited the probability of the space station becoming a source of debris as a result of collisions with large debris or other operational space stations.

AMAZONAS NEXUS will coexist with AMAZONAS 2 until its end of life and then will replace it at 61.0° W.L. and these satellites may be nominally collocated during transfer of traffic, as well as with AMAZONAS 3 and AMAZONAS 5 satellites, all operated by Hispamar that will coordinate all operations to ensure safe collocation. For these cases, Hispamar will ensure that sufficient spatial separation is achieved between these satellites through the use of orbit eccentricity and inclination offsets and thus minimize the risk of collision.

Hispamar is not aware of any other FCC licensed system, or any other system applied for and under consideration by the FCC, having an overlapping station-keeping volume with AMAZONAS NEXUS. Hispamar is also not aware of any system with an overlapping station-keeping volume with AMAZONAS NEXUS that is the subject of an ITU filing and that is either in orbit or progressing towards launch.

Hispamar uses different systems and services to monitor the risk of close approach of its satellites with other objects, like GMV's *focusoc* and European Union Space Surveillance and Tracking Collision Avoidance services. Any close encounters, with miss distance less than 10 km, are flagged and investigated in more detail.

Post Mission Disposal

At the end of the mission, Hispamar will dispose of the spacecraft by moving it to an altitude of at least 283 kilometers above the geostationary arc. Hispamar intends to reserve 3 kilograms of propellant (Xenon) for that purpose. The reserved propellant figure is an estimate. This figure is calculated taking into account the expected mass of the satellite at the end of life, the fuel gauging uncertainty and the required delta-velocity to achieve the desired orbit.

In calculating the disposal orbit, Hispamar has used the effective area to mass ratio ($C_r \cdot A/M$) of the satellite that is **0.031** m²/kg, resulting in a minimum increase in perigee altitude under the Inter-Agency Space Debris Coordination Committee formula of **281** kilometers above the geostationary arc.

Such formula is:

*Minimum increase in perigee altitude (altitude above geostationary orbit) = 235 km +
1000 x CR x A / M*

Accordingly, AMAZONAS NEXUS's planned disposal orbit complies with the FCC's rules.

ANNEX A

In this Annex the maximum antenna boresight gain point latitude and longitudes, rounded to the nearest 0.1 degree, of each identical fixed spot beam within each beam group described in Schedule S as specified by Section 25.114(c)(4)(vii)(B) are provided.

Coordinates of user spot beams with beam size 1.3°

Lon (°E)	Lat (°N)	Pol. UL	UL Beam Type	Pol. DL	DL Beam Type
-115.23	47.94	H	US1H	V	US2V
-97.32	46.18	H	US1H	V	US2V
-85.13	45.29	H	US1H	V	US2V
-74.84	44.8	H	US1H	V	US2V
-65.37	44.57	H	US1H	V	US2V
-110.34	38.62	V	US1V	H	US2H
-96.65	37.54	V	US1V	H	US2H
-86.23	36.91	V	US1V	H	US2H
-77.19	36.51	V	US1V	H	US2H
-109.98	31.04	H	US1H	V	US2V
-97.67	30.24	H	US1H	V	US2V
-88.02	29.73	H	US1H	V	US2V
-79.61	29.41	H	US1H	V	US2V
-111.54	24.3	V	US1V	H	US2H
-99.6	23.67	V	US1V	H	US2H
-90.26	23.26	V	US1V	H	US2H
-82.16	22.99	V	US1V	H	US2H
-74.73	22.81	V	US1V	H	US2H

Coordinates of user spot beams with beam size 1.8°

Lon (°E)	Lat (°N)	Pol. UL	UL Beam Type	Pol. DL	DL Beam Type
-68.26	33.7	V	US3V	H	US4H
-65.71	15.99	H	US3H	V	US4V

Coordinates of gateway spot beams

Lon (°E)	Lat (°N)	Pol. UL	UL Beam Type	Pol. DL	DL Beam Type
-96.08	41.29	RHCP	GW1R	LHCP	GW2L
-96.08	41.29	LHCP	GW1L	RHCP	GW2R
-74.53	41.2	RHCP	GW1R	LHCP	GW2L
-74.53	41.2	LHCP	GW1L	RHCP	GW2R
-111.91	40.56	RHCP	GW1R	LHCP	GW2L

-111.91	40.56	LHCP	GW1L	RHCP	GW2R
-106.92	32.27	RHCP	GW1R	LHCP	GW2L
-106.92	32.27	LHCP	GW1L	RHCP	GW2R

ANNEX B

In this Annex an interference analysis demonstrating compatibility with a hypothetical co-frequency space station two degrees away with the same receiving and transmitting characteristics as the proposed space station, as required by Section 25.140(a)(3)(vi) are provided.

This analysis considers the frequency bands not included in section 25.140(a)(3)(ii): 17.7 – 18.3 GHz and 27.5 – 28.35 GHz. For 4 different services for Forward Links and Return Links.

		FORWARD			
		aero	maritime	residential	backhaul
Carrier bandwidth	MHz	156.3	156.3	156.3	156.3
Uplink:		Ka-band	Ka-band	Ka-band	Ka-band
Uplink Frequency	GHz	27.630	27.630	27.630	27.630
Earth Station Diameter	m	9.00	9.00	9.00	9.00
Earth Station Gain	dBi	66.0	66.0	66.0	66.0
Earth station EIRP	dBW	84.00	84.00	84.00	84.00
Atmospheric Losses	dB	0.30	0.30	0.30	0.30
Free Space Loss	dB	212.8	212.8	212.8	212.8
Satellite G/T	dB/K	18.2	18.2	18.2	18.2
Geogr. Correction	dB	0.0	0.0	0.0	0.0
C/N Thermal Uplink	dB	35.9	35.9	35.9	35.9
C/I Additional sources	dB	19.1	19.1	19.1	19.1
C/(N+I) uplink	dB	19.0	19.0	19.0	19.0
Downlink:		Ku-band	Ku-band	Ku-band	Ku-band
Downlink Frequency	GHz	12.0	12.0	12.0	12.0
Satellite EIRP per carrier	dBW	59.8	59.8	59.8	59.8
Atmospheric Losses	dB	0.20	0.20	0.20	0.20
Free Space Path Loss	dB	205.2	205.2	205.2	205.2
Geogr. Correction	dB	4.0	4.0	4.0	4.0
Earth Station Diameter	m	0.45	1.20	0.75	2.40
Earth Station Gain	dBi	34.0	40.5	36.5	46.5
Earth Station G/T	dB/K	11.1	17.8	13.5	24.2
C/N Thermal Downlink	dB	15.9	22.6	18.3	29.0
C/I Additional sources	dB	13.5	13.5	13.5	13.5
C/(N+I) downlink	dB	11.4	12.8	12.1	13.1
Adjacent Satellite Interference:					
C/I up (single satellite @2°)	dB	45.6	45.6	45.6	45.6
C/I dn (single satellite @2°)	dB	6.0	13.9	9.0	26.0
Aggregate C/I up	dB	19.1	19.1	19.1	19.1
Aggregate C/I down	dB	5.3	10.7	7.7	12.9
Overall:					
C/(N+I) overall	dB	4.7	9.7	7.0	11.9
C/(N+I) required	dB	4.2	9.6	6.9	11.8
Margin	dB	0.5	0.1	0.1	0.1

Technology		DVS-2X	DVS-2X	DVS-2X	DVS-2X
ModCod		QPSK 3/4	16APSK 2/3	16APSK-L 1/2	16APSK 5/6
Efficiency	bps/ baud	1.448	2.666	2.044	3.205

		RETURN			
		aero	maritime	residential	backhaul
Carrier bandwidth	MHz	7.6	7.6	7.6	7.6
Uplink:		Ku-band	Ku-band	Ku-band	Ku-band
Uplink Frequency	GHz	14.375	14.375	14.375	14.375
Earth Station Diameter	m	0.45	1.20	0.75	2.40
Earth Station Gain	dBi	36.90	42.90	38.80	48.90
Earth station EIRP	dBW	55.70	61.70	57.60	67.70
Atmospheric Losses	dB	0.30	0.30	0.30	0.30
Free Space Loss	dB	207.4	207.4	207.4	207.4
Satellite G/T	dB/K	11.1	11.1	11.1	11.1
Geogr. Correction	dB	4.5	4.5	4.5	4.5
C/N Thermal Uplink	dB	14.7	20.7	16.6	26.7
C/I Additional sources	dB	13.8	13.8	13.8	13.8
C/(N+I) uplink	dB	11.2	13.0	12.0	13.6
Downlink:		Ka-band	Ka-band	Ka-band	Ka-band
Downlink Frequency	GHz	17.900	17.900	17.900	17.900
Satellite EIRP per carrier	dBW	52.8	52.8	52.8	52.8
Atmospheric Losses	dB	0.30	0.30	0.30	0.30
Free Space Path Loss	dB	209.0	209.0	209.0	209.0
Geogr. Correction	dB	0.0	0.0	0.0	0.0
Earth Station Diameter	m	9.00	9.00	9.00	9.00
Earth Station Gain	dBi	62.3	62.3	62.3	62.3
Earth Station G/T	dB/K	40.3	40.3	40.3	40.3
C/N Thermal Downlink	dB	43.8	43.8	43.8	43.8
C/I Additional sources	dB	21.7	21.7	21.7	21.7
C/(N+I) downlink	dB	20.3	20.3	20.3	20.3
Adjacent Satellite Interference:					
C/I up (single satellite @2°)	dB	16.5	22.5	18.4	28.5
C/I dn (single satellite @2°)	dB	41.9	41.9	41.9	41.9
Aggregate C/I up	dB	11.9	13.2	12.5	13.7
Aggregate C/I down	dB	21.7	21.7	21.7	21.7
Overall:					
C/(N+I) overall	dB	10.8	12.4	11.5	13.0
C/(N+I) required	dB	10.5	12.3	11.3	13.0
Margin	dB	0.3	0.1	0.2	0.0
Technology		DVS-2X	DVS-2X	DVS-2X	DVS-2X
ModCod		16APSK 3/4	16APSK 6/7	16APSK 4/5	32APSK 3/4
Efficiency	bps/ baud	2.881	3.289	3.074	3.519