SECTION 25.114 (d) TECHNICAL INFORMATION

SECTION 25.114 (d) INFORMATION FOR AMAZONAS-3 SPACE STATION IN THE Ka BAND

(1) General description of overall system facilities, operations and services;

AMAZONAS-3 is a multi-mission system with payloads in C-band, Ku-Band and Ka-Band. AMAZONAS-3 will be a replacement of AMAZONAS-1 in C and Ku bands and will add extra-capacity in Ka band. This system will be used to satisfy the needs of communications by satellite in Europe and in the Americas.
HISPAMAR will operate AMAZONAS-3 satellite system at 61º W.L. to provide a wide range of telecommunications services, including routing and DTH delivery of video and audio programs, satellite news gathering, VSAT applications, internet backbone services, broadband links, multimedia and interactive services, capacity for both public and private networks, etc.

(2) If applicable, the feeder link and inter-satellite service frequencies requested for the satellite, together with any demonstration otherwise required by this chapter for use of those frequencies (see, e.g., §§25.203(j) and (k));

N/A

(3) Predicted space station antenna gain contour(s) for each transmit and each receive antenna beam and nominal orbital location requested. These contour(s) should be plotted on an area map at 2 Db intervals down to 10 Db below the peak value of the parameter and at 5 Db intervals between 10 Db and 20 Db below he peak values, with the peak value and sense of polarization clearly specified on each plotted contour. For applications for geostationary orbit satellites, this information must be provided in the .gxt format.

Ka Band

The station antenna gain contour in copolar and crosspolar for the SPOT beams are contained electronically in .gxt format in the files named:

- SAO PAULO:
  RT1U_C.GXT (SAO PAULO receive beam left hand polarization, copolar), *RT1U_X.GXT* (SAO PAULO receive beam left hand polarization, crosspolar), *RT9U_C.GXT* (SAO PAULO receive beam right hand polarization, copolar), *RT9U_X.GXT* (SAO PAULO receive beam right hand polarization, crosspolar), *FW9D_C.GXT* (SAO PAULO transmit beam left hand polarization, copolar), *FW9D_X.GXT* (SAO PAULO transmit beam left hand polarization, crosspolar), *FW1D_C.GXT* (SAO PAULO transmit beam right hand polarization, copolar), *FW1D_X.GXT* (SAO PAULO transmit beam right hand polarization, crosspolar) attached to this application.

- SANTIAGO:
  RT6U_C.GXT (SANTIAGO receive beam right hand polarization, copolar), *RT6U_X.GXT* (SANTIAGO receive beam right hand polarization, crosspolar), *FW6D_C.GXT* (SANTIAGO transmit beam left hand polarization, copolar), *FW6D_X.GXT* (SANTIAGO transmit beam left hand polarization, crosspolar) attached to this application.

- RIO:
  RT9U_C.GXT (RIO receive beam right hand polarization, copolar), *RT9U_X.GXT* (RIO receive beam right hand polarization, crosspolar),

FW9D_C.GXT (RIO transmit beam left hand polarization, copolar), *FW9D_X.GXT* (RIO transmit beam left hand polarization, crosspolar) attached to this application.

- MEXICO:
  RT3U_C.GXT (MEXICO receive beam left hand polarization, copolar), *RT3U_X.GXT* (MEXICO receive beam left hand polarization, crosspolar), *RT5U_C.GXT* (MEXICO receive beam right hand polarization, copolar), *RT5U_X.GXT* (MEXICO receive beam right hand polarization, crosspolar), *FW5D_C.GXT* (MEXICO transmit beam left hand polarization, copolar), *FW5D_X.GXT* (MEXICO transmit beam left hand polarization, crosspolar), *FW3D_C.GXT* (MEXICO transmit beam right hand polarization, copolar), *FW3D_X.GXT* (MEXICO transmit beam right hand polarization, crosspolar) attached to this application.

- LIMA:
  RT8U_C.GXT (LIMA receive beam left hand polarization, copolar), *RT8U_X.GXT* (LIMA receive beam left hand polarization, crosspolar), *FW8D_C.GXT* (LIMA transmit beam right hand polarization, copolar), *FW8D_X.GXT* (LIMA transmit beam right hand polarization, crosspolar) attached to this application.

- BUENOS AIRES:
  RT2U_C.GXT (BUENOS AIRES receive beam left hand polarization, copolar), *RT2U_X.GXT* (BUENOS AIRES receive beam left hand polarization, crosspolar), *FW2D_C.GXT* (BUENOS AIRES transmit beam right hand polarization, copolar), *FW2D_X.GXT* (BUENOS AIRES transmit beam right hand polarization, crosspolar) attached to this application.

- BOGOTA:
  RT7U_C.GXT (BOGOTA receive beam left hand polarization, copolar), *RT7U_X.GXT* (BOGOTA receive beam left hand polarization, crosspolar), *FW7D_C.GXT* (BOGOTA transmit beam right hand polarization, copolar), *FW7D_X.GXT* (BOGOTA transmit beam right hand polarization, crosspolar) attached to this application.

- LAREDO:
  FW5U_C.GXT (LAREDO receive beam left hand polarization, copolar), *FW5U_X.GXT* (LAREDO receive beam left hand polarization, crosspolar), *FW3U_C.GXT* (LAREDO receive beam right hand polarization, copolar), *FW3U_X.GXT* (LAREDO receive beam right hand polarization, crosspolar), *RT3D_C.GXT* (LAREDO transmit beam left hand polarization, copolar), *RT3D_X.GXT* (LAREDO transmit beam left hand polarization, crosspolar), *RT5D_C.GXT* (LAREDO transmit beam right hand polarization, copolar), *RT5D_X.GXT* (LAREDO transmit beam right hand polarization, crosspolar), *FW9U_C.GXT* (LAREDO receive beam left hand polarization, copolar), *FW9U_X.GXT* (LAREDO receive beam left hand polarization, crosspolar), *FW2U_C.GXT* (LAREDO receive beam right hand polarization, copolar), *FW2U_X.GXT* (LAREDO receive beam right hand polarization, crosspolar), *RT2D_C.GXT* (LAREDO transmit beam left hand polarization, copolar), *RT2D_X.GXT* (LAREDO transmit beam left hand polarization, crosspolar), *RT9D_C.GXT* (LAREDO transmit beam right hand polarization, copolar), *RT9D_X.GXT* (LAREDO transmit beam right hand polarization, crosspolar) attached to this application.

- TUCSON:
  FW6U_C.GXT (TUCSON receive beam left hand polarization, copolar), *FW6U_X.GXT* (TUCSON receive beam left hand polarization, crosspolar), *FW1U_C.GXT* (TUCSON receive beam right hand polarization, copolar), *FW1U_X.GXT* (TUCSON receive beam right hand polarization, crosspolar), *RT1D_C.GXT* (TUCSON transmit beam left hand polarization, copolar), *RT1D_X.GXT* (TUCSON transmit beam left hand polarization, crosspolar), *RT6D_C.GXT* (TUCSON transmit beam right hand polarization, copolar), *RT6D_X.GXT* (TUCSON transmit beam right hand polarization, crosspolar), *FW8U_C.GXT* (TUCSON receive beam left hand polarization, copolar), *FW8U_X.GXT* (TUCSON receive beam left hand polarization, crosspolar), *FW7U_C.GXT* (TUCSON receive beam right hand polarization, copolar), *FW7U_X.GXT* (TUCSON receive beam right hand polarization, crosspolar), *RT7D_C.GXT* (TUCSON transmit beam left hand polarization, copolar), *RT7D_X.GXT* (TUCSON transmit beam left hand polarization, crosspolar), *RT8D_C.GXT* (TUCSON transmit beam right hand polarization, copolar), *RT8D_X.GXT* (TUCSON transmit beam right hand polarization, crosspolar) attached to this application.

For all the beams, the gain peak for receiving antenna is 52 dBi and for the transmitting antenna 48 dBi, for both polarizations.

(4) A description of the types of services to be provided, and the areas to be served, including a description of the transmission characteristics and performance objectives for each type of proposed service, details of the link noise budget, typical or baseline earth station parameters, modulation parameters, and overall link performance analysis (including an analysis of the effects of each contributing noise and interference source);

The Ka band of AMAZONAS-3 satellite will be used for digital communications services, including video and internet applications, with bit rates ranging from 1 Mbit/s, possibly less, to 1 Gbit/s.

The Ka band of AMAZONAS-3 satellite has several spot beams providing services to different cities of America.

The files called *Forward Ka-band 1.pfd* to *Forward Ka-band 4.pfd, return ka 1.pdf to return ka 5.pdf* and *DTH Ka-band 9.pdf* (for Ka band) attached to this application, contain several examples of link noise budgets. Also these link budgets are a two-degree spacing interference analysis for AMAZONAS-3.

(5) Calculation of power flux density levels within each coverage area and of the energy dispersal, if any, needed for compliance with §25.208; Calculation of power flux density levels within each coverage area and of the energy dispersal, if any, needed for compliance with §25.208, for angles of arrival other than 5°, 10°, 15°, 20°, and 25° above the horizontal.

<u>Ka Band</u>

In all the Ka downlink frequency range, the power flux density at the Earth's surface produced by emissions from a space station for all conditions and for all methods will not exceed -123.5 dBW/m2 1 MHz over the US territory and all the Americas:

-69.5 dBW/Hz max psd + 48 (max gain dBi) - 162 spreading losses (dB) (worst case).

(6) Public interest considerations in support of grant;

The Ka band of AMAZONAS-3 satellite will ensure digital transmission services between the United States and different cities of America.

The entry of the AMAZONAS-3 satellite into the market to meet US customers' demand for such services will enhance competition in that market. Accordingly, the grant of this application is in the public interest.

(7) Applications for authorizations for fixed-satellite space stations shall also include the information specified in §25.140 (b)(1) and (2) of this part. Applicants for authorizations for space stations in the 17/24 GHz broadcasting-satellite service must also include the information specified in Sec. Sec. 25.140(b)(1) and (3) of this part.

The files called *Forward Ka-band 1.pfd* to *Forward Ka-band 4.pfd, return ka 1.pdf to return ka 5.pdf* and *DTH Ka-band 9.pdf* (for Ka band) attached to this application, contain several examples of two-degree spacing interference analysis for AMAZONAS-3.

(8) Applications for authorizations in the Mobile-Satellite Service in the 1545–1559/1646.5–1660.5 MHz frequency bands shall also provide all information necessary to comply with the policies and procedures set forth in Rules and Policies Pertaining to the Use of Radio Frequencies in a Land Mobile Satellite Service, 2 FCC Rcd 485 (1987) (Available at address in §0.445 of this chapter.);

N/A

(9) Applications to license multiple space station systems in the non-voice, non-geostationary mobile-satellite service under blanket operating authority shall also provide all information specified in §25.142; and

N/A

(10) Applications for authorizations in the 1.6/2.4 GHz Mobile-Satellite Service shall also provide all information specified in §25.143.

N/A

(11) In addition to a statement of whether the space station is to be operated on a common carrier basis, or whether non-common carrier transactions are proposed, as specified in paragraph (c)(11) of this section, satellite applications in the Direct

Broadcast Satellite service must provide a clear and detailed statement of whether the space station is to be operated on a broadcast or non-broadcast basis.

N/A

(12) **Applications for authorizations in the non-geostationary satellite orbit fixed-satellite service (NGSO FSS) in the bands 10.7 GHz to 14.5 GHz shall also provide all information specified in §25.146.**

N/A

(13) **For satellite applications in the Direct Broadcast Satellite service, if the proposed system's technical characteristics differ from those specified in the Appendix 30 BSS Plans, the Appendix 30A feeder link Plans, Annex 5 to Appendix 30 or Annex 3 to Appendix 30A, each applicant shall provide:**

(i) **The information requested in Appendix 4 of the ITU's Radio Regulations. Further, applicants shall provide sufficient technical showing that the proposed system could operate satisfactorily if all assignments in the BSS and feeder link Plans were implemented.**

(ii) **Analyses of the proposed system with respect to the limits in Annex 1 to Appendices 30 and 30A.**

N/A

(14) **A description of the design and operational strategies that will be used to mitigate orbital debris including the following information:**

(i) **A statement that the space station operator has assessed and limited the amount of debris released in a planned manner during normal operations, and has assessed and limited the probability of the space station becoming a source of debris by collisions with small debris or meteoroids that could cause loss of control and prevent post-mission disposal;**

The spacecraft is designed such that no debris will be released during normal operations. As part of the daily routine operations, an analysis using a public catalogue of orbital objects is conducted to avoid any collision, preventing the spacecraft to become a source of debris.

(ii) **A statement that the space station operator has assessed and limited the probability of accidental explosions during and after completion of mission operations. This statement must include a demonstration that debris generation will not result from the conversion of energy sources on board the spacecraft into energy that fragments the spacecraft. Energy sources include chemical, pressure, and kinetic energy. This demonstration should address whether stored energy will be removed at the spacecraft's end of life, by depleting residual fuel and leaving all fuel line valves open, venting any pressurized system, leaving all batteries in a permanent discharge state, and removing any remaining source of stored energy, or through other equivalent procedures specifically disclosed in the application;**

Please, see Attachment A.

(iii) **A statement that the space station operator has assessed and limited the probability of the space station becoming a source of debris by collisions with large debris or other operational space stations. Where a space station will be launched into a low-Earth orbit that is identical, or very similar, to an orbit used by other space stations, the statement must include an analysis of the potential risk of collision and a description of what measures the space station operator plans to take to avoid in-orbit collisions. If the space station operator is relying on coordination with another system, the statement must indicate what steps have been taken to contact, and ascertain the likelihood of successful coordination of physical operations with, the other system. The statement must disclose the accuracy--if any--with which orbital parameters of non-geostationary satellite orbit space stations will be maintained, including apogee, perigee, inclination, and the right ascension of the ascending node(s). In the event that a system is not able to maintain orbital tolerances, i.e., it lacks a propulsion system for orbital maintenance, that fact should be included in the debris mitigation disclosure. Such systems must also indicate the anticipated evolution over time of the orbit of the proposed satellite or satellites. Where a space station requests the assignment of a geostationary-Earth orbit location, it must assess whether there are any known satellites located at, or reasonably expected to be located at, the requested orbital location, or assigned in the vicinity of that location, such that the station keeping volumes of the respective satellites might overlap. If so, the statement must include a statement as to the identities of those parties and the measures that will be taken to prevent collisions;**

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. As part of the daily routine operations, an analysis using a public catalogue of orbital objects is conducted to avoid any collision, preventing the spacecraft to become a source of debris.

The proposed orbital location for AMAZONAS-3 is 61° W.L. same as AMAZONAS-1 and AMAZONAS-2. AMAZONAS-3 will be a replacement of AMAZONAS-1 for the C and the Ku bands and will add extra-capacity in the Ka band. AMAZONAS-3 will be maintained on the geostationary orbit within a window of less than +/-0.07° in North-South and less than +/- 0.05º East-West. It will be co-located with the other three satellites The co-location strategy is coordinated for all the satellites in the cluster and will be based on separation in eccentricity and inclination method assuring no collisions between the satellites.

(iv) **A statement detailing the post-mission disposal plans for the space station at end of life, including the quantity of fuel--if any--that will be reserved for post-mission disposal maneuvers. For geostationary-Earth orbit space stations, the statement must disclose the altitude selected for a post-mission disposal orbit and the calculations that are used in deriving the disposal altitude. The statement must also include a casualty risk assessment if planned**

post-mission disposal involves atmospheric re-entry of the space station. In general, an assessment should include an estimate as to whether portions of the spacecraft will survive re-entry and reach the surface of the Earth, as well as an estimate of the resulting probability of human casualty.

At the end of the mission, HISPAMAR will dispose of the spacecraft by moving it to a minimum altitude of 414 kilometers above the geostationary arc. This exceeds the minimum altitude established by the IADC formula.

HISPAMAR has reserved 16.2 kilograms of fuel for this purpose. This fuel figure was determined by the spacecraft manufacturer and provided for in the propellant budget. To calculate this figure, the "rocket equation" was used, taking into account the expected mass of the satellite at the end of life and the required delta-velocity to achieve the desired orbit. The fuel gauging uncertainty has been taken into account in these calculations.

In calculating the disposal orbit, HISPAMAR has used simplifying assumptions as permitted under the Commission's Orbital Debris Report and Order. For reference, this calculation results in a minimum perigee disposal altitude under the IADC formula of at most 276 kilometers above the geostationary arc, which is lower than the 414 kilometers above geostationary disposal altitude specified by HISPAMAR.

For additional information, please see Attachment A.

(15) **Each applicant for a space station license in the 17/24 GHz BSS shall include the following information as an attachment to its application:**

(i) **Except as set forth in paragraph (d)(15)(ii) of this section, an applicant proposing to operate in the 17.3-17.7 GHz frequency band, must provide a demonstration that the proposed space station will comply with the power flux density limits set forth in Sec. 25.208(w) of this part.**

(ii) **In cases where the proposed space station will not comply with the power flux density limits set forth in Sec. 25.208(w) of this part, the applicant will be required to provide a certification that all potentially affected parties acknowledge and do not object to the use of the applicant's higher power flux densities. The affected parties with whom the applicant must coordinate are those GSO 17/24 GHz BSS satellite networks located up to 6 away for excesses of up to 3 dB above the power flux-density levels specified in Sec. 25.208(w) of this part, and up to 10 away greater for excesses greater than 3 dB above those levels.**

(iii) **In cases where the proposed 17/24 GHz BSS space station will be operated in the 17.3-17.7 GHz band, or operated to provide international service in the 17.7-17.8 GHz band, and cannot be located precisely at one of the nominal 17/24 GHz BSS orbital locations specified in Appendix F of the Report and Order, adopted May 2, 2007, IB Docket No. 06-123, FCC 07-76, the applicant must provide a demonstration that the proposed space station will not cause more interference to other 17/24 GHz BSS satellite networks operating in compliance with the rules for this service than if it**

were located at the precise 17/24 GHz BSS orbital location from which its proposed location is offset.

(iv) An applicant proposing to provide international service in the 17.7-17.8 GHz band must demonstrate that it will meet the power flux density limits set forth in Sec. 25.208(c) of this part.

N/A

(16) In addition to the requirements of paragraph (d)(15) of this section, each applicant for a license to operate a 17/24 GHz BSS space station that will be used to provide video programming directly to consumers in the United States, that will not meet the requirements of Sec. 25.225 of this part, must include as an attachment to its application a technical analysis demonstrating that providing video programming service to consumers in Alaska and Hawaii that is comparable to the video programming service provided to consumers in the 48 contiguous United States (CONUS) is not feasible as a technical matter or that, while technically feasible, such service would require so many compromises in satellite design and operation as to make it economically unreasonable.

N/A

ATTACHMENT A

AMZ3 End of Life Disposal Plan

The plan for disposing of the AMZ3 satellite at end of life ensures that all stored energy sources on board the satellite are discharged to the maximum extent practicable, by venting excess propellant, discharging batteries, relieving pressure vessels, and all other appropriate measures.

The following sequence describes the process flow, rather than detail, with emphasis on what we are achieving and the main considerations.

Starting point

All payload ground station Uplink traffic is off.
Bus systems are normal (Attitude Control / Data Handling /Power / Propulsion).
Satellite is at or near Geosynch orbit.

Deactivate Payload

Turn off all payload units including TWTA's, LCAMP's, LNA's, Downconverters, Beacons, MLO's & MRO's. This will ensure no Payload RF radiation will interfere with other spacecraft.

Configure Attitude Control Safety System Monitors

Configure Attitude Control Safety System per Satellite On-orbit Operating Handbook for Sun Acquisition Mode. This is the final control mode which provides stability of spacecraft spinning in Pitch axis and is the default mode of the S/C processor which will eventually be powering up/down whenever the solar arrays are either illuminated or shadowed, respectively, until the arrays degrade to a point such that no current to the 100V bus can be produced.
]

Configure TT&C

Establish High Power Wide Angle Telemetry and Command mode by command.
HPWA is established prior to the first de-orbit maneuver to obtain a wider FOV as the orbit is raised.

Perform Transfer Orbit Maneuver

Transfer vehicle from operational orbit to parking orbit. (See details on page 3)

Make Satellite Safe

Fire Unused Pyro's

Fire all unfired pyros (Solar Array and Reflector hold downs, propellant system, etc.)

Depressurize Bi Propulsion System & He Pressurant

Activate earth deck thrusters until all six thrusters indicate fuel and ox depletion (sputtering). Earth deck thrusters are used to raise orbit as much as possible.

Slew Solar Arrays to Sun pointing, and perform Sun Acquisition.

Activate anti-earth deck thrusters to purge remaining fuel/ox from lines and complete propulsion subsystem depressurization.

After it has been determined that only one propellant is remaining, repressurize the Ox and Fuel tanks to depressurize He from Pressurant tank to lowest practicable pressure. After repressurizing the propellant tanks, the He isolation valve is closed to preclude any possibility of residual bipropellants from leaching into the pressurant system and causing a hypergolic reaction.

Thruster valves may cycle open if the processor reboots and achieves Sun Acq mode control before losing power again as the spacecraft spins about its pitch axis. Some propellant will not be expellable and will remain in the propulsion system.

Spin Down Momentum Wheels
Remaining ACS is not shut down so that the satellite will remain in Sun Acquisition mode when power from the S/A activates the bus. The momentum wheels are spun down to reduce the spacecraft "stiffness", thus, minimizing the pressurant required to transition the spacecraft to Sun Acquisition mode.

Deactivate Electrical Power System

Turn OFF all the Battery Chargers to keep the batteries from recharging.
Open Battery Relays to further preclude the ability to recharge the batteries.
Turn OFF all Battery Power Control Unit Dischargers to ensure no battery power is applied to the bus.
Deplete charge from all batteries.

As long as the solar arrays can produce enough power when illuminated by the sun, the S/C processors will attempt to reboot in Sun Acq mode whenever 100V power is available from the arrays; when the array power goes away, and with the batteries depleted, everything will turn off again.

Disable Telemetry and Tracking System
Command Off Telemetry transmitter 1 and 2 to ensure no RF radiation will interfere with other spacecraft.

End of Satellite Life

End-of-Life Deorbit

The End-of-Life (EOL) deorbit maneuver consists of two delta Vs (one at each apsis) in the direction of motion which raise the satellite into a circular orbit above synchronous radius (as shown in Figure 1. Total delta Vs of approximately 15 m/s raise the EOL circular orbit radius greater than 400 km above synchronous. To reduce the bipropellant requirement, the helium pressurant in the propellant tank can be used for part of the EOL deorbit maneuver.

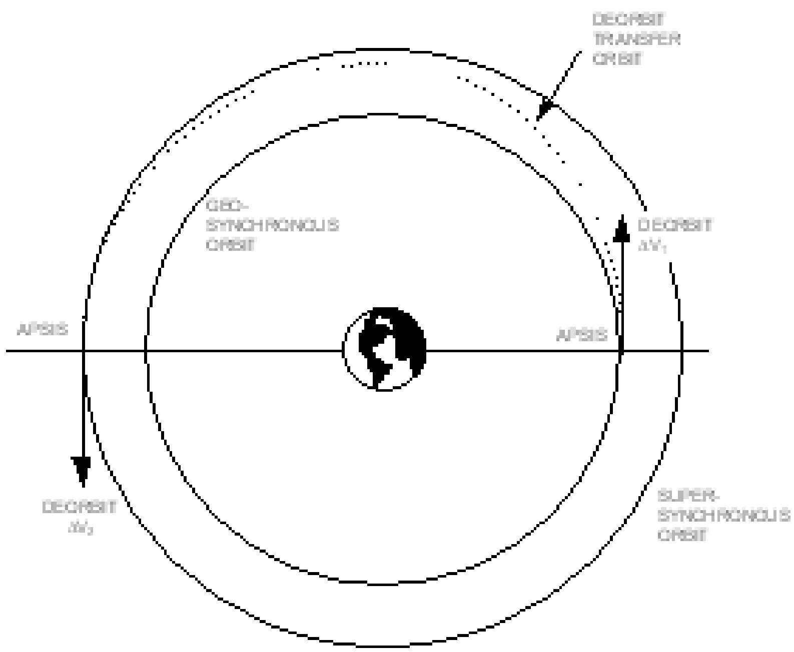

Figure 1. End-of-Life Deorbit Geometry