Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of Amendment to the Application of Panasonic Avionics Corporation To Modify AMSS License To Permit Operation of Up to 2000 Technically Identical Aeronautical Mobile-Satellite Service ("AMSS") Aircraft Earth Stations ("AESs") in the 14.0-14.5 GHz and 10.95-12.75 GHz Frequency Bands	))))))))	Call Sign E100089 File No. _____

AMENDMENT TO MODIFICATION APPLICATION

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Panasonic Avionics Corporation ("Panasonic"), licensee of the eXConnect aeronautical mobile-satellite service ("AMSS") system, hereby amends its pending application to modify its existing blanket license to operate Ku-band aircraft earth stations ("AESs").[1] Panasonic seeks to make the following changes to its pending modification application: (i) provide supplemental orbital debris mitigation/end-of-life disposal information and include associated waiver requests for the E10A and Anik F1 satellites; (ii) add the Amazonas 2 satellite as a proposed satellite point of communication; and (iii) include the Southeast Pacific (SEP) beam of the U.S.-licensed E172A satellite in the service area of the eXConnect System.

As described herein, the foregoing changes will facilitate expeditious consideration of the application by the Commission. In addition, prompt grant of the application, as amended, will strongly serve the public interest.

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[1] *See* Application of Panasonic Avionics Corporation To Modify AMSS License To Permit Operation of Up to 2000 Technically Identical Aeronautical Mobile-Satellite Service ("AMSS") Aircraft Earth Stations ("AESs") in the 14.0-14.5 GHz and 10.7-12.75 GHz Frequency Bands, File No. SES-MFS-20120913-00818 ("Modification Application").

I. INTRODUCTION

As initially filed on September 13, 2012, the Modification Application sought authority to communicate with the following satellite points of communication:[2]

- E172A (formerly GE 23)
- Superbird C2
- Asiasat 5
- Yamal 201
- E10A (formerly W2A)
- Anik F1
- Estrela do Sul 2 (T-14R)
- Intelsat 14
- Apstar 6
- Apstar 7
- T-11N

Subsequently, on January 9, 2013, Panasonic amended the Modification Application[3] to provide information about the orbital debris mitigation/end-of-life disposal plans for the following satellites: Superbird C2, Asiasat 5, Yamal 201, E10A, Anik F1, Apstar 6 and Apstar 7.

On February 6, 2013, the Satellite Division of the Commission's International Bureau released a letter dismissing, without prejudice to re-filing, the portions of the modification application that sought to add the Asiasat 5, Superbird C2, Yamal 201, Apstar 6 and Apstar 7 satellites as a result of inconsistencies between the Commission's orbital debris/end-of-life disposal requirements and the information included in the Orbital Debris Amendment.[4] The Satellite Division also sought clarification of certain issues relating to the orbital debris mitigation/end-of-life disposal plans for these satellites, as well as the Anik F1 and E10A satellites. However, Panasonic's request to communicate with the Anik F1 and E10A satellites was not dismissed.

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[2] Galaxy 17 was previously authorized as the satellite point of communication under Call Sign E100089.

[3] IBFS File No. SES-AMD-20130109-00028 ("Orbital Debris Amendment").

[4] *See* Letter from Fern J. Jarmulnek, Federal Communications Commission, to Carlos N. Nalda, Counsel to Panasonic Avionics Corporation, dated February 6, 2013, DA 13-164 (IBFS File Nos. SES-MFS-20120913-00818; SES-AMD-20130109-00028) ("Satellite Division Letter").

Panasonic is filing this amendment to clarify and supplement the orbital debris mitigation/end-of-life disposal information for the Anik F1 and E10A satellites, and to add certain points of communication that are either U.S.-licensed or on the Permitted Space Station List. Panasonic is also separately withdrawing the Orbital Debris Mitigation Amendment. Panasonic respectfully requests that the Commission expeditiously proceed with final acceptance for filing review of the Modification Application, as amended herein.

II. AMENDMENT OF PROPOSED SATELLITE POINTS OF COMMUNICATION

During the pendency of the Modification Application, implementation plans for the eXConnect System have evolved. Panasonic now seeks to include the Amazonas 2 satellite as an authorized point of communication and another beam of the E172A satellite to its network.[5]

A. Removal of Satellite Points of Communications

Panasonic acknowledges that dismissal of its request to communicate with the Superbird C2, Asiasat 5, Yamal 201, Apstar 6 and Apstar 7 satellites, and is withdrawing the orbital debris mitigation/end-of-life plans from the record of this application proceeding. Panasonic is working with its foreign satellite partners to develop more detailed orbital debris mitigation/end-of-life disposal showings. In the meantime, Panasonic respectfully requests that the Commission process the Modification Application, as amended herein, to enable Panasonic to communicate with those satellites that do not require additional time to provide more extensive orbital debris mitigation/end-of-life disposal information.

B. Addition of Satellite Points of Communications

Panasonic seeks to add Amazonas 2, a Brazilian-licensed satellite on the Permitted Space Station List, to the Modification Application as an authorized point of communication for the

[5] Panasonic also intends to include additional foreign licensed satellites in a subsequent filing.

eXConnect System. Information regarding the proposed operation with Amazonas 2, including a link budget, emission designators and service area, are included in the attached Technical Appendix.[6]

Panasonic will communicate with Amazonas 2 within North America, including the continental United States, at power levels that are fully consistent with the Commission's two-degree spacing rules. Panasonic currently communicates with the G-17 satellite pursuant to the same technical parameters. Because Amazonas 2 is on the Permitted Space Station List, the Commission has already reviewed and approved the orbital debris mitigation/end-of-life disposal information for the satellite and determined that access to the U.S. market would serve the public interest.

Although not a new satellite point of communication, Panasonic also seeks to operate in the SEP beam of the E172A satellite, which was not part of Panasonic's original Modification Application. Information regarding the proposed operation with E172A SEP, including a link budget, emission designators and service area, are included in the attached Technical Appendix.[7] Panasonic has also attached a letter from Eutelsat America, the licensee of the E172A satellite, confirming that Panasonic's proposed operations are consistent with the coordinated parameters of the satellite.[8] Because the E172A satellite is a U.S.-licensed satellite, the Commission has already reviewed and approved the orbital debris mitigation/end-of-life disposal information for the satellite and, as described in the Modification Application and herein, access to the E172A satellite would serve the public interest.

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[6] Attachment 1 hereto, Technical Appendix at 1-1 through 1-4.

[7] *Id*. at 2-1 through 2-4.

[8] *Id*. at 2-3. Eutelsat America is aware of Panasonic's proposed operations on all E172A satellite beams, including those in the original Modification Application and the SEP beam proposed herein.

C. Satellites, Downlink Frequencies and Service Areas

Given the changes to the Modification Application, as amended herein, Panasonic summarizes the proposed satellite points of communication, downlink frequencies and associated services areas below:

Satellite	Orbital Location	Downlink Frequencies	Coverage Areas/ ITU Regions (R)	STA Operations in the U.S.?
E172A	172° E	11.45-11.7 GHz	North Pacific (R2, R3)	Yes (AK, HI)
		11.61-11.70 GHz	Southeast Pacific (R2, R3)	No
		10.95-11.2 GHz 11.45-11.7 GHz	Southwest Pacific (R3) (Oceania, SE Asia)	No
		12.2-12.75 GHz	South Pacific (R2, R3) (Australia/NZ)	No
G-17	91° W	11.7-12.2 GHz	North America (R2)	Yes (CONUS)
Estrela do Sul 2 (T-14R)	63 ° W	11.45-12.2 GHz	N. Atlantic Ocean (R1, 2) (Canada and Atlantic)	No
Telstar 11N	37.5° W	11.45-12.2 GHz	Atlantic Ocean (R1, 2)	No
		11.7-12.2 GHz	United States (R2)	Yes (CONUS)
E10A	10° E	10.95-11.70 GHz, 12.5-12.75 GHz[9]	Europe, Northern Africa (R1)	No
Anik F1	107.3° W	11.45-12.2 GHz	South America (R2)	No
IS-14	45° W	12.25-12.75 GHz	Europe, Northern Africa (R1)	No
Amazonas 2	61° W	11.7-12.2 GHz	North America	Yes (CONUS)

As the Commission is aware, AMSS receive operations in Ku-band FSS downlink spectrum are on a non-conforming unprotected, non-interference basis only. In its original Modification Application, Panasonic requested a waiver of the U.S. Table of Allocations, 47

[9] This downlink frequency range for the E10A satellite reflects a correction from the information included in the Technical Appendix included with the Modification Application. *See* Modification Application, Attachment 1, Technical Appendix at 23. In addition, Panasonic has attached a letter from Eutelsat, operator of the E10A satellite, confirming that Panasonic's proposed operations are consistent with the coordinated parameters of the satellite.

C.F.R. §2.106, with respect to the downlink bands for its proposed satellite points of communication. Given the addition of Amazonas 2 and the downlink bands currently associated with the application, Panasonic extends its waiver request to all satellites and receive bands identified above. In this connection, Panasonic will only utilize receive spectrum allocated for FSS downlinks, will not claim protection from conforming uses of the spectrum and will cease operations upon notification that its receive operations are causing interference to any conforming use of the band.

D. Satellite Orbital Debris Mitigation/End-of-Life Information

1. Additional Information for Eutelsat 10A and Request for Waiver

Panasonic is resubmitting the orbital debris mitigation/end-of-life disposal plan provided by Eutelsat for the E10A satellite.[10] The Satellite Division noted that the information submitted for the E10A satellite states that it will contain some unvented pressure vessels at the end of life.[11] In addition, the submitted orbital debris mitigation plan states that during passivation at end of life, the satellite's propellant tanks will be depressurized "as much as possible."[12] The Satellite Division asked Panasonic to provide any additional information in support of its waiver request of Section 25.283(c), such as the factors that limit the possibility of discharging all stored propellant at end of life.[13]

The E10A satellite, launched in 2009, is based on the Alcatel Alenia Space Spacebus-

[10] Attachment 1 hereto, Technical Appendix at 4-2.

[11] *Satellite Division Letter* at 4.

[12] Attachment 1 hereto, Technical Appendix at 4-2, at 6.

[13] *Satellite Division Letter* at 4. Section 25.283(c) requires that all stored energy be discharged at the end of life of the spacecraft. Section 25.113(d)(14)(ii), 47 C.F.R. § 25.114(d)(14)(ii), requires applicants to submit information that addresses "whether stored energy will be removed at the spacecraft's end of life."

4000C4 platform, which includes liquid propellants as well as a helium gas pressurant. We have been advised that during end-of-life passivation, Eutelsat will evacuate the propulsion systems to the maximum extent technically feasible. However, it is impractical to evacuate the remaining gas down to zero pressure (due to capillary forces and other factors), with some remaining at end of life at a pressure of typically below 1 bar.

In addition, as in indicated in the attached E10A orbital debris mitigation/end-of-life disposal plan, there will be a small amount of residual helium remaining in a tank used to pressurize the main propulsion system shortly after launch.[14] After completion of the launch phase, this tank, now largely depleted, was actively isolated with a small amount of remaining helium so it is not possible to further vent the gas.

Because it is impractical from a design perspective to achieve full venting, and impossible to retrieve the satellite from orbit, Panasonic requests a waiver of Section 25.283(c). The Commission may grant a waiver of its rules under the following conditions:

> The Commission may waive a rule for good cause shown. Waiver is appropriate if special circumstances warrant a deviation from the general rule and such deviation would better serve the public interest than would strict adherence to the general rule. Generally, the Commission may grant a waiver of its rules in a particular case if the relief requested would not undermine the policy objective of the rule in question and would otherwise serve the public interest.[15]

Granting the requested waiver of Section 25.283(c) would be consistent with Commission precedent and policy.

There is ample precedent in in support of Panasonic's waiver request. The Commission has in the past waived Section 25.283(c) for in-orbit spacecraft with similar end-of-life

[14] Attachment 1 hereto, Technical Appendix at 4-2, at 6, 7.

[15] PanAmSat Licensee Corp., 17 FCC Rcd. 10483, ¶ 22 (Int'l Bur. 2002) (footnotes omitted).

limitations.[16] The Commission has even waived this rule in a number of cases to permit the launch and operation of spacecraft that do not allow for full venting of pressure vessels at end of life, based on a finding that modifying the space station design at a late stage of construction would pose an undue hardship.[17]

The Spacebus-4000C4 platform on is a satellite bus design that was developed before the Commission adopted its rules in 2004 pertaining to orbital debris and venting requirements.[18] Although completion of construction and launch of E10A occurred after adoption of the Commission's rules, significant redesign of critical subsystems would have posed an undue hardship in the form of costly reengineering and delay of a standard and widely used satellite bus. This is particularly relevant since E10A serves the Europe/North Africa regions, not U.S. territory, and there was no basis at the time of design and launch that the U.S. orbital debris requirements would be applied to the satellite.

Furthermore, with E10A already in orbit and operational, there is no possibility of

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[16] *See, e.g., Telesat Canada*, File Nos. SAT-APL-20111117-00222, SAT-PPL-20110630-00123, Call Sign S2703, grant-stamped Apr. 11, 2012, Attachment at ¶ 3 (granting partial waiver of Section 25.283(c) for Anik F2, an in-orbit spacecraft unable to vent residual helium at end of life); *Hispamar Satellites, S.A.*, File Nos. SAT-PPL-20100506-00093, SAT-APL-20101209-00247, Call Sign S2793, grant-stamped Dec. 21, 2010, Attachment at ¶ 1 (granting waiver of Section 25.283(c) in connection with residual helium that will be present on in-orbit Amazonas 2 satellite at end of life).

[17] *See, e.g.*, DIRECTV Enterprises, LLC, File No. SAT-LOA-20090807-00086, grant-stamped Dec. 15, 2009, Attachment at ¶ 4 (granting a partial waiver of Section 25.283(c) for DIRECTV-14, a Boeing 702 model spacecraft, on grounds that requiring modification of the satellite would present an undue hardship EchoStar Satellite Operating Corp., File No. SAT-LOA-20071221-00183, grant-stamped Mar. 12, 2008, Attachment at ¶ 4 (same for AMC-14 satellite, a Lockheed Martin A2100 model spacecraft); PanAmSat Licensee Corp., File Nos. SAT-MOD-20070207-00027 and SAT-AMD-20070716-00102, grant-stamped Oct. 4, 2007) Attachment at ¶ 7 (same for Intelsat 11 satellite, an Orbital Sciences Star model spacecraft).

[18] *Mitigation of Orbital Debris*, Second Report and Order, 19 FCC Rcd 11567 (2004) ("*Second Report and Order*").

bringing the satellite into compliance with the rule. The Commission has expressly recognized this, finding a waiver of Section 25.283(c) to be justified for in-orbit spacecraft that cannot satisfy the rule's requirements. For example, in a decision involving the SES AMC-2 satellite, the Commission waived Section 25.283(c) on its own motion, observing that venting the spacecraft's sealed oxidizer tanks "would require direct retrieval of the satellite, which is not currently possible."[19]

The same practical obstacles are present here. Although the satellite operator can enable venting of pressure in the propellant tanks, it cannot eliminate the *de minimis* residual pressure. In addition, because E10A is already in orbit and direct access is impossible, the minimal pressure remaining in the helium tank cannot be addressed. Given these circumstances, and consistent with Commission precedent, Panasonic respectfully submits that a waiver of Section 25.283(c) to permit access to the E10A satellite would serve the public interest.

2. Additional Information Regarding Anik F1 and Request for Waiver

Panasonic is resubmitting the orbital debris mitigation/end-of-life disposal plan provided by Telesat Canada for the Anik F1 satellite.[20] The Satellite Division asked for additional details

[19] SES Americom, Inc., Call Sign S2134, File No. SAT-MOD-20101215-00261, grant-stamped Mar. 8, 2011, Attachment at ¶ 4. *See also* XM Radio Inc., Call Sign S2616, File No. SAT-MOD-20100722-00165, grant-stamped Oct. 14, 2010, Attachment at ¶ 2 (waiving Section 25.283(c) for XM-4 satellite, a Boeing 702 model spacecraft, because "modification of the spacecraft would present an undue hardship, since XM-4 is an in-orbit space station and venting XM-4's helium and xenon tanks would require direct retrieval of the satellite, which is not currently possible"); *Telesat Canada*, File No. SAT-APL-20111117-00222, SAT-PPL-20110630-00123, Call Signs S2703, grant-stamped Apr. 11, 2012, Attachment at ¶ 3 (granting partial waiver of Section 25.283(c) for Anik F3, an in-orbit, spacecraft unable to vent residual helium at end of life); *Hispamar Satélites, S.A*, File Nos. SAT-PPL-20100506-00093 & SAT-APL-20101209-00257, Call Sign S2793, grant-stamped Dec. 21, 2010, Attachment at ¶ 1 (granting waiver of Section 25.283(c) in connection with residual helium that will be present on the in-orbit Amazonas 2 at its end of life).

[20] Attachment 1 hereto, Technical Appendix at 3-1.

regarding stored energy on Anik F1 at the end of its life.[21] Specifically, the Division sought clarification regarding whether all stored energy would be depleted at Anik F1's end of life and, if any propellant, oxidizer or fuel would remain on board, what would be the mass and volume of each class of gas remaining.[22]

The Anik F1 design includes a helium tank that was sealed by firing a pyrotechnic valve after transfer orbit.[23] As a result, there will be residual amounts of helium remaining onboard this satellite at end of life and it is impossible for the satellite operators to fully vent all helium onboard the spacecraft, as required by Section 25.283(c) of the Commission's rules. We have been advised that the tank size is 68.8 liters. There are 90 g. of helium remaining in the tank, and the estimated remaining pressure is 400 kPa, approximately equal to 58 Psi. The helium tank is built to withstand pressures of up to 36.2 MPa, or approximately 5250 Psi. The minimal unvented helium remaining is well below the pressure rating of the tank and presents no risk of creating orbital debris at any time during or after the satellite's mission life. The spacecraft's oxidizer and fuel will be fully vented.

Panasonic also notes that Anik F1 is listed on the Permitted List.[24] An orbital debris mitigation plan need not be filed with the Commission for earth stations seeking to communicate

[21] *Satellite Division Letter* at 4.

[22] *Id*.

[23] *See* Letter of Karis A. Hastings, Counsel for SES Americom, Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission, Notice of *Ex Parte* Presentation, IB Docket No. 02-84, 2 (Oct. 29, 2009). Telesat Canada further explains in its orbital debris mitigation/end-of-life disposal plan that "all stored energy onboard the spacecraft will be removed." *See* "Anik F1 Satellite End of Life Disposal and Debris Mitigation Plan," Attachment 1 hereto, Technical Appendix. This should have stated that all possible stored energy will be removed. In any case, because helium is inert and the residual pressure remaining in the helium tank is far below the tank's tolerance, there remains no explosive risk, as originally stated.

[24] *See* Telesat Canada, SAT-PDR-20000420-00083, Call Sign S2745, DA 00-2835, Order, 15 FCC Rcd. 24828 (Sat. and Rad. Div., released Dec. 19, 2000).

with non-U.S. licensed space stations that have already been authorized as a point of communication in a regular earth station authorization or that have been listed on the Permitted List.[25] However, Anik F1 was added to the Permitted List prior to the release of the Commission's orbital debris rules; therefore, Panasonic provides the attached orbital debris information and requests a waiver of Commission rule 25.283(c) to the extent the Commission deems necessary to permit addition of Anik F1 as an authorized point of communication.

As previously discussed, the Commission may grant a waiver of its when "special circumstances warrant a deviation from the general rule and such deviation would better serve the public interest than would strict adherence to the general rule."[26] Grant is appropriate when a waiver would not "undermine the policy objective of the rule in question and would otherwise serve the public interest."[27]

Under Commission policy and precedent, grant of such a waiver is warranted in this case. First, Anik F1 was launched in 2000, well before the Commission adopted its orbital debris rules in 2004.[28] Because launch of the satellite predates the rules, waiver will not undermine the public policy objective behind the venting requirement. Additionally, Anik F1 is already in orbit, which the Commission has found to justify waiver of Section 25.283(c) because at this stage venting the spacecraft's sealed tank would require direct retrieval of the satellite, which is not currently possible.[29]

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[25] See 47 C.F.R. § 25.137.

[26] PanAmSat Licensee Corp., 17 FCC Rcd. 10483, ¶ 22 (Int'l Bur. 2002) (footnotes omitted).

[27] *Id*.

[28] *See* Anik F1 Fact Sheet, Telesat, http://www.telesat.com/sites/default/files/satellite/anikf1_a4.pdf; *Second Report and Order* (2004).

[29] *See* note 19, *supra*.

Finally, because Anik F1 is currently on the Permitted List and has been for more than ten years, grant of the requested waiver would be consistent with the Commission's treatment of the satellite for the past decade. For these reasons, a waiver of Section 25.283(c), to the extent necessary to allow Panasonic's terminals to communicate with for the Anik F1 satellite, would serve the public interest.

III. PUBLIC INTEREST STATEMENT

As described in the Modification Application, including the next-generation terminal and additional satellite points of communications in the eXconnect System will serve the public interest by enabling Panasonic to provide more efficient and extensive in-flight connection to U.S. and foreign airline passengers and crew. Additional public interest factors associated with the issues implicated by this amendment are set forth below.

A. Amazonas 2

The addition of the Amazonas 2 satellite at 61º W.L. as an authorized point of communication would serve the public interest. Amazonas 2, a Brazilian-licensed satellite operated by Hispamar Satélites S.A. ("Hispamar"), has been authorized to access the U.S. market by inclusion in the Commission's Permitted Space Station List.[30] Panasonic has attached hereto a letter from Hispamar confirming that Panasonic's proposed operations are consistent with the coordinated parameters of the satellite, which are compliant with the Commission's two-degree spacing rules.[31] In addition, the Commission recently concluded that it should extend

[30] Call Sign S2793, File No. SAT-PPL-20100506-00093, grant-stamped Dec. 21, 2010; see also File Nos. SAT-APL-20101209-00257 and SAT-PPL-20090806-00081, grant-stamped Oct. 15, 2009.

[31] Attachment 1 hereto, Technical Appendix at 1-3.

ALSAT/Permitted List authority to Ku-band aeronautical terminals that operate in compliance with its two-degree spacing policies.[32]

Authorizing Panasonic to communicate with Amazonas 2 satellite is plainly consistent with the public interest. Panasonic requires the additional capacity from Amazonas 2 to serve the increasing demand for in-flight broadband service aboard aircraft in U.S. airspace. This satellite capacity is used not only by U.S.-based carriers, but also by foreign airlines that access the eXConnect network while transiting U.S. airspace. Authorization to communicate with Amazonas 2 will allow Panasonic to ensure maximum performance, reliability and flexibility of its operations in the United States.

B. E172A SEP Beam

Although the E172A was included in Panasonic's original Modification Application, addition of the SEP beam will extend the geographic coverage of the eXConnect System in the Pacific Ocean region. As noted in the attached letter from Eutelsat America, Panasonic's proposed operations are consistent with the coordinated parameters of the satellite. For the reasons set forth in the Modification Application, as supplemented herein, expanded communications with the E172A satellite would serve the public interest.

[32] *Revisions to Parts 2 and 25 of the Commission's Rules to Govern the Use of Earth Stations Aboard Aircraft Communicating with Fixed-Satellite Service Geostationary-Orbit Space Stations Operating in the 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.2 GHz and 14.0-14.5 GHz Frequency Bands Service Rules and Procedures to Govern the Use of Aeronautical Mobile Satellite Service Earth Stations in Frequency Bands Allocated to the Fixed Satellite Service, IB Docket No. 12-376; Service Rules and Procedures to Govern the Use of Aeronautical Mobile Satellite Service Earth Stations in Frequency Bands Allocated to the Fixed Satellite Service*; IB Docket No. 05-20, Notice of Proposed Rulemaking and Report and Order, FCC 12-161, ¶ 112 (rel. Dec. 28, 2012).

C. Waivers of Section 25.283(c) for Anik F1 and E10A

Panasonic has provided supplemental information regarding the orbital debris mitigation/end-of-life disposal plans of the Anik F1 and E10A satellites. This information was sought by the Commission to clarify information provided by the relevant satellite operators in their orbital debris mitigation plans. In addition, Panasonic has requested a waiver of Section 25.283(c)'s venting requirements with respect to the E10A and Anik F1 satellites.

For the reasons discussed above, the Commission should accept the orbital debris mitigation/end-of-life disposal information for the E10A and Anik F1 satellites and grant a waiver of Section 25.283(c) with respect to both satellites. Foreign airlines equipped with eXConnect terminals are currently communicating with these satellites and granting similar authority will ensure that U.S. airline passengers and crew obtain the full benefit of in-flight connectivity afforded by Panasonic's global eXConnect System.

D. Other Issues

1. Off-Axis EIRP Spectrum Density Mask

Panasonic's original Modification Application included an off-axis EIRP spectral density mask that is stricter than the Commission's rules for Ku-band aeronautical terminals and other mobile VSATs.[33] Specifically, Panasonic included a pointing offset of 0.2 degrees in calculating the maximum off-axis EIRP spectral density that may be produced by the antenna, which is represented by the "(θ +0.2)" term in the mask. This modified mask reflects Panasonic's conservative approach to avoiding adjacent satellite interference and has been included in certain satellite operator letters in describing Panasonic proposed operations.[34] The mask set forth in the

[33] *See* Modification Application, Narrative Statement at 10.

[34] *See, e.g.*, Letter from José Edio Gomes and Carlos González, Hispamar, to Federal Commission, at 2 (Jan. 18, 2013), attached hereto in Attachment 1, Technical Appendix at 1-3.

Modification Application is stricter than that applied by the Commission (which does not include a pointing accuracy offset) and further ensures that Panasonic's proposed operations will not cause harmful interference into adjacent satellites.

2. Gateway Earth Stations

Panasonic also takes this opportunity to provide an updated table of the gateway earth stations for each of the proposed satellite points of communications:

Satellite	Gateway Earth Station	
	Location (City/Country)	**Operator**
Amazonas 2	Brewster, WA	USEI
Anik F1	Lima, Peru	NewCom
E10A	Cologne, Germany	Stellar
E172A (NP/SWP)	Brewster, WA	USEI
E172A (SP)	Adelaide, Australia	ASC
E172A (SEP)	Brewster, WA	USEI
Estrela do Sul 2	Mt. Jackson, VA	Telesat
G-17	Ellenwood, GA	Intelsat
IS-14	Cologne, Germany	Stellar
T-11N-AOR	Ellenwood, GA	Intelsat

IV. CONCLUSION

Panasonic hereby amends its pending Modification Application to update its proposed satellite points of communication and provide supplemental orbital debris mitigation/end-of-life disposal information for certain foreign-licensed satellites. As discussed in the Modification Application and herein, grant of the Modification Application would strongly serve the public interest. Panasonic respectfully requests that the Commission expeditiously consider and grant the application, as amended, to facilitate the provision of in-flight connectivity offerings to passengers and crews aboard aircraft traversing U.S. airspace, and aboard U.S.-registered aircraft traveling around the world.

ATTACHMENT 1

TECHNICAL APPENDIX

TECHNICAL APPENDIX

CONTENTS SUMMARY

[a] No additional orbital debris information is required for satellites licensed by the Commission or on the Commission's Permitted Space Station List.

[b] This information was provided in previous filings.

[c] The coordination letter has been requested.

Amazonas-2

Coverage Map

Amazonas-2

Link Budget

Link Budget – AMAZONAS-2

Forward Link Budget

eXConnect Terminal

Site	Brewster	
Antenna Type	EMS Revised Noise Temperature	
Lat	47.5	deg
Lon	-120.4	deg
EIRP max	42.5	dBW
G/T	10.0	dB/K

Satellite

Name	Amazonas-2	
Transponder	0.0	
Longitude	-61.0	deg

Hub Earth Station

Site	Brewster_6.3m	
Lat	48.1	deg
Lon	-119.8	deg
EIRP max	80.0	dBW
G/T	35.0	dB/K

Signal

Waveform	DVB-S2	
Modulation	QPSK	
Bits per symbol	2	
Spread Factor	1	
Coding Rate	0.89	
Overhead Rate	0.95	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	1.69	bps/Hz
Data Rate	5.06E+07	bps
Information Rate (Data + Overhead)	5.33E+07	bps
Symbol Rate	3.00E+07	Hz
Chip Rate (Noise Bandwidth)	3.00E+07	Hz
Occupied Bandwidth	3.60E+07	Hz
Power Equivalent Bandwidth	3.60E+07	Hz
C/N Threshold	6.6	dB

Return Link Budget

eXConnect Terminal

Site	Brewster	
Antenna Type	EMS Revised Noise Temperature	
Lat	47.5	deg
Lon	-120.4	deg
EIRP max	42.5	dBW
G/T	10.0	dB/K

Satellite

Name	Amazonas-2	
Transponder	0.0	
Longitude	-61.0	deg

Hub Earth Station

Site	Brewster_6.3m	
Lat	48.1	deg
Lon	-119.8	deg
EIRP max	80.0	dBW
G/T	35.0	dB/K

Signal

Waveform	iDirectRL-SF4	
Modulation	BPSK	
Bits per symbol	1	
Spread Factor	4	
Coding Rate	0.43	
Overhead Rate	0.68	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	0.07	bps/Hz
Data Rate	4.85E+05	bps
Information Rate (Data + Overhead)	7.18E+05	bps
Symbol Rate	1.67E+06	Hz
Chip Rate (Noise Bandwidth)	6.66E+06	Hz
Occupied Bandwidth	7.99E+06	Hz
Power Equivalent Bandwidth	4.77E+05	Hz
C/N Threshold	-5.0	dB

Uplink

Frequency	14.250	GHz
Power Control Mode	Automatic Uplink Power Control	
Back off	12.3	dB
EIRP Spectral Density	29.0	dBW/4kHz
Slant Range	40405	km
Space Loss, Ls	207.7	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	2.6	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	4.0	dB/K
Thermal Noise, C/No	90.1	dBHz
Intra-System Interference, C/Io ISI	1000.0	dBHz
Adj. Satellite Interference, C/Io ASI	99.2	dBHz
Cross-Pol Interference, C/Io XP	196.9	dBHz
C/(No+Io)	89.6	dBHz

Satellite

Flux Density	-98.0	dBW/m2
SFD @ Hub	-96.0	dBW/m2
Small Signal Gain (IBO/OBO)	1.0	dB
OBO	1.0	dB

Uplink

Frequency	14.144	GHz
Power Control Mode	Automatic Uplink Power Control	
Back off	0.0	dB
EIRP Spectral Density	10.3	dBW/4kHz
Slant Range	40419	km
Space Loss, Ls	207.6	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.0	dB
Transponder G/T @ Terminal	4.0	dB/K
Thermal Noise, C/No	67.4	dBHz
Intra-System Interference, C/Io ISI	1000.0	dBHz
Adj. Satellite Interference, C/Io ASI	76.5	dBHz
Cross-Pol Interference, C/Io XP	173.7	dBHz
C/(No+Io)	66.9	dBHz

Satellite

Flux Density	-120.8	dBW/m2
SFD @ Terminal	-96.0	dBW/m2
Small Signal Gain (IBO/OBO)	3.0	dB
OBO	21.8	dB

Downlink

Frequency	11.950	GHz
Transponder Sat. EIRP @ Beam Peak	54.5	dBW
Transponder Sat. EIRP @ Terminal	53.0	dBW
DL PSD Limit	15.0	dBW/4kHz
DL PSD @ Beam Peak	14.8	dBW/4kHz
Carrier EIRP @ Beam Peak	53.5	dBW
Carrier EIRP @ Terminal	52.0	dBW
Slant Range	40419	km
Space Loss, Ls	206.1	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	84.4	dBHz
Intermod. Interference, C/IMo	175.6	dBHz
Intra-System Interference, C/Io ISI	1000.0	dBHz
Adj. Satellite Interference, C/Io ASI	91.6	dBHz
Cross-Pol Interference, C/Io XP	183.8	dBHz
C/(No+Io)	83.6	dBHz

End to End

End to End C/(No+Io)	82.7	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	6.9	dB
Link Margin	0.3	dB

Downlink

Frequency	11.844	GHz
Transponder Sat. EIRP @ Beam Peak	54.5	dBW
Transponder Sat. EIRP @ Hub	53.0	dBW
DL PSD Limit	15.0	dBW/4kHz
DL PSD @ Beam Peak	0.5	dBW/4kHz
Carrier EIRP @ Beam Peak	32.8	dBW
Carrier EIRP @ Hub	31.2	dBW
Slant Range	40405	km
Space Loss, Ls	206.0	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	3.0	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	85.7	dBHz
Intermod. Interference, C/IMo	156.8	dBHz
Intra-System Interference, C/Io ISI	1000.0	dBHz
Adj. Satellite Interference, C/Io ASI	94.9	dBHz
Cross-Pol Interference, C/Io XP	163.0	dBHz
C/(No+Io)	85.2422	dBHz

End to End

End to End C/(No+Io)	66.8	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	-1.4	dB
Link Margin	3.6	dB

Amazonas-2

Coordination Letter(s)

hispamar
satélites

January 18th, 2013

Federal Communications Commission
International Bureau
445 12th Street, S.W.
Washington, D.C. 20554

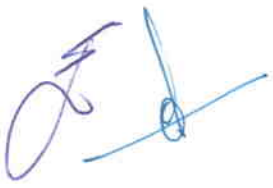
To Whom It May Concern:

This letter certifies that Hispamar is aware that Panasonic Avionics Corporation ("PAC") is seeking FCC authorization to access the Amazonas 2 at 61° W.L. as an authorized point of communication for its eXConnect Ku-band aeronautical mobile-satellite service ("AMSS") system to operate within U.S. airspace using transmit/receive antennas and moreover that the operational conditions imposed to PAC terminal over Amazonas-2 will be consistent with Hispamar's coordination agreements and will comply with the FCC's two-degree spacing rules and will not result in unacceptable interference.

The basic characteristics provided by PAC of the eXConnect phased array terminal (also known as the Aura LE terminal) are summarized in Table 1.

Table 1. Aura LE Antenna Characteristics

Characteristic	Aura LE
Frequency	Tx: 14.0 GHz to 14.5 GHz Rx: 10.7 GHz to 12.75 GHz
Aperture Size	2 Apertures of 34.7" X 6.6" each
EIRP	48.0 dBW @ 90 deg Elevation
G/T	10 - 14 dB/K
Tracking Rate	40 deg/sec in Azimuth 20 deg/sec in Elevation
Az Pointing Accuracy	0.2 deg 1-sigma



The off-axis EIRP spectral density limits applied to AMSS operations are the same as those defined for ESV and VMES operations[1]. The off-axis EIRP spectral density generated by an AMSS terminal operating in a two-degree spacing environment should not exceed:

15–25log10 (Θ + 0.2)	dBW/4 kHz	for	$1.5° \leq \Theta \leq 7°$
−6	dBW/4 kHz	for	$7° < \Theta \leq 9.2°$
18–25log10(Θ + 0.2)	dBW/4 kHz	for	$9.2° < \Theta \leq 48°$
−24	dBW/4 kHz	for	$48° < \Theta \leq 85°$
−14	dBW/4 kHz	for	$85° < \Theta \leq 180°$

where Θ is the angle in degrees from the line connecting the focal point of the antenna to the orbital location of the target satellite.

The eXConnect system will limit off-axis EIRP spectral density to the levels coordinated for the Amazonas 2 satellite (in particular with those in the arc of ±6 degrees) through various means, including: (i) limiting transmit power spectral density by controlling the transmit power of the terminal and by selecting appropriate carrier bandwidths; (ii) controlling the off-axis gain of the antenna along the GSO by inhibiting transmissions when the skew angle exceeds a specified threshold and (iii) controlling pointing error and inhibiting transmissions when the pointing offset exceeds a threshold of 0.35 . The specific transmit power, bandwidth and skew angle thresholds will be selected based on the desired terminal transmission rates, coverage area, and satellite performance.

Please let me know if you require any additional information regarding PAC's operation of the eXConnect phased-array AMSS terminal on the Amazonas 2 satellite.

Sincerely,

José Edio Gomes
Hispamar

JAN 18th, 2013
Date

Carlos González
Hispamar

[1] Off-axis EIRP spectral density levels are set forth in analogous Ku-band earth station onboard vessels ("ESV") and vehicle-mounted earth stations ("VMES") rules. *See* 47 C.F.R. § 25.222 and 25.226.

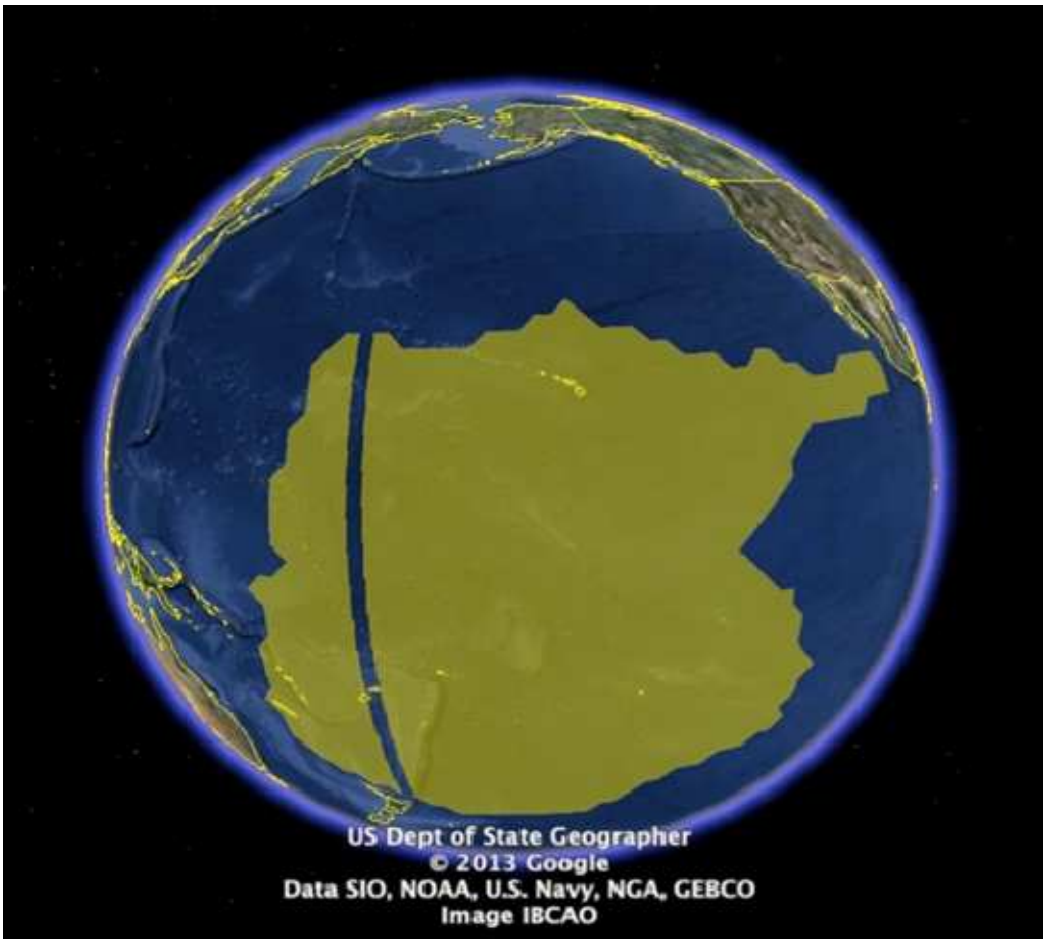
Amazonas-2

Emission Designators

Satellite and Beam Name	Tx/Rx	Emission Designator	Bandwidth (Hz)	Max EIRP (dBW)	ESD Limit (dBW/Hz) (From Link Budget)	ESD Limit (dBW/4Hz)	Max EIRP per Carrier (dBW) (FCC Entry)	Max EIRP per Carrier (dBW/4kHz)
Amazonas-2	Tx	500KG7D	500,000	48	-20.1	15.92	36.10	15.92
Amazonas-2	Tx	9M00KG7D	9,000,000	48	-20.1	15.92	48.00	15.27
Amazonas-2	Rx	1M20KG7D	1,200,000					
Amazonas-2	Rx	36M0KG7D	36,000,000					

E172A

Coverage Map



Note: The apparent North-South "gap" in coverage is actually a depiction of the International Date Line in Google Earth ™. Coverage is provided throughout this region.

Link Budget

Link Budget - E172A

Forward Link Budget

eXConnect Terminal

Site	Hawaii, USA	
Antenna Type	AURA LE	
Lat	19.5	deg
Lon	-158.1	deg
EIRP max	47.0	dBW
G/T	12.0	dB/K

Satellite

Name	GE-23	
Transponder	NPH7N/SEPV7N	
Longitude	172.0	deg

Hub Earth Station

Site	Brewster	
Lat	47	deg
Lon	-122	deg
EIRP max	80.0	dBW
G/T	35.0	dB/K

Signal

Waveform	DVB-S2	
Modulation	QPSK	
Bits per symbol	2	
Spread Factor	1	
Coding Rate	0.75	
Overhead Rate	0.92	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Nois	1.39	bps/Hz
Data Rate	3.46E+06	bps
Information Rate (Data + Ove	3.75E+06	bps
Symbol Rate	2.50E+06	Hz
Chip Rate (Noise Bandwidth)	2.50E+06	Hz
Occupied Bandwidth	3.00E+06	Hz
Power Equivelent Bandwidth	6.40E+06	Hz
C/N Threshold	4.4	dB

Uplink

Frequency	14.453	GHz
Back off	12.5	dB
EIRP Spectral Density	39.6	dBW/4kH
Slant Range	40858	km
Space Loss, Ls	207.9	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss,	5.2	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	1.0	dB/K
Thermal Noise, C/No	84.0	dBHz
C/(No+Io)	83.5	dBHz

Return Link Budget

eXConnect Terminal

Site	Hawaii, USA	
Antenna Type	AURA LE	
Lat	19.5	deg
Lon	-158.1	deg
EIRP max	47.0	dBW
G/T	12.0	dB/K

Satellite

Name	GE-23	
Transponder	/6W/NPH6W	
Longitude	172.0	deg

Hub Earth Station

Site	Brewster	
Lat	47	deg
Lon	-122	deg
EIRP max	80.0	dBW
G/T	35.0	dB/K

Signal

Waveform	DirectRL-SF8	
Modulation	BPSK	
Bits per symbol	1	
Spread Factor	4	
Coding Rate	0.43	
Overhead Rate	0.68	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW	0.07	bps/Hz
Data Rate	4.86E+05	bps
Information Rate (Data + Overhea	7.18E+05	bps
Symbol Rate	1.67E+06	Hz
Chip Rate (Noise Bandwidth)	6.67E+06	Hz
Occupied Bandwidth	8.00E+06	Hz
Power Equivelent Bandwidth	4.87E+05	Hz
C/N Threshold	-5.0	dB

Uplink

Frequency	14.199	GHz
Back off	0.2	dB
EIRP Spectral Density	14.6	dBW/4k
Slant Range	37139	km
Space Loss, Ls	206.9	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.0	dB
Transponder G/T @ Terminal	0.0	dB/K
Thermal Noise, C/No	68.4	dBHz
C/(No+Io)	67.9	dBHz

Satellite		
Flux Density	-101.0	dBW/m2
SFD @ Hub	-88.7	dBW/m2
Small Signal Gain (IBO/OBO)	1.9	dB
OBO	10.3	dB
Downlink		
Frequency	11.653	GHz
Transponder Sat. EIRP @ Bea	46.5	dBW
Transponder Sat. EIRP @ Terr	45.0	dBW
DL PSD Limit	13.0	dBW/4kH
DL PSD @ Beam Peak	8.2	dBW/4kH
Carrier EIRP @ Beam Peak	36.2	dBW
Carrier EIRP @ Terminal	34.7	dBW
Slant Range	37139	km
Space Loss, Ls	205.2	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss,	0.0	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	70.0	dBHz
Intermod. Interference, C/IM	168.1	dBHz
C/(No+Io)	69.6	dBHz
End to End		
End to End C/(No+Io)	69.5	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	4.5	dB
Link Margin	0.1	dB

Satellite		
Flux Density	-115.7	dBW/m
SFD @ Terminal	-88.0	dBW/m
Small Signal Gain (IBO/OBO)	1.9	dB
OBO	25.8	dB
Downlink		
Frequency	11.149	GHz
Transponder Sat. EIRP @ Beam Pe	46.0	dBW
Transponder Sat. EIRP @ Hub	46.0	dBW
DL PSD Limit	13.0	dBW/4k
DL PSD @ Beam Peak	-12.0	dBW/4k
Carrier EIRP @ Beam Peak	20.2	dBW
Carrier EIRP @ Hub	20.2	dBW
Slant Range	40858	km
Space Loss, Ls	205.6	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	5.1	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	73.1	dBHz
Intermod. Interference, C/IMo	156.9	dBHz
C/(No+Io)	72.5913	dBHz
End to End		
End to End C/(No+Io)	66.6	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	-1.6	dB
Link Margin	3.4	dB

Coordination Letter(s)

eutelsatamerica
communications via satellite

February 4, 2013

Mark DeFazio
Manager, GCS Regulatory and Business Operations
Panasonic Avionics Corporation
26200 Enterprise Way
Lake Forest, CA 92630

Re: Application of Panasonic Avionics Corporation
Call Sign E100089, File No. SES- MFS-20120913-00818

Dear Mr. DeFazio:

In connection with Panasonic Avionics Corporation's ("PAC's") above-captioned application ("Application") to the Federal Communications Commission;[1] you have requested that Eutelsat confirm it has reviewed the technical characteristics of PAC's Ku-band aeronautical mobile-satellite service ("AMSS") operations with the Eutelsat 172A satellite ("E172A," formerly GE-23). You would like Eutelsat to certify that such operations are consistent with Eutelsat's coordination agreements for the satellite and that, when operated in the prescribed manner, such operations do not result in unacceptable interference.

As set forth in the Application, the basic characteristics of the PAC phased-array ("PPA") aircraft earth station ("AES") terminal (referred to in the Application as the "Aura LE" terminal) for operation with the E172A satellite at 172°E.L. include:[2]

Antenna Dimensions	34.7 inches (0.88 m) 6.6 inches height (0.17 m)
Type of Antenna	Dual panel waveguide fed phased array
SSPA Rated Output Power	16 watts
Bandwidth	10.70 GHz to 12.75 GHz 14.0 GHz to 14.5 GHz

[1] Application of Panasonic Avionics Corporation To Modify AMSS License To Permit Operation of Up to 2000 Technically Identical Aeronautical Mobile-Satellite Service ("AMSS") Aircraft Earth Stations ("AESs") in the 14.0-14.5 GHz and 10.7-12.75 GHz Frequency Bands, Call Sign E100089, File No. SES-MFS-20120913-00818 ("Application").

[2] *See id.* at 4.

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Washington, DC 20006
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Transmit Gain	38 dBi
EIRP	48 dBW
Transmit Polarization	Horizontal or Vertical
Receive G/T	10 to 14 dB/K
Transmit Azimuth Beamwidth	1.5 degrees
Transmit Elevation Beamwidth	4 degrees

We understand that the terminal is designed to comply with the FCC's rules and policies governing Ku-band earth stations onboard aircraft ("ESAAs") adopted in new Section 25.227 of the rules.[3]

You have advised Eutelsat that the PPA AES avoids interference to other satellite operations by limiting off-axis EIRP spectral density to no more than the levels specified in the contract between Eutelsat and Panasonic, through various means, including: (i) limiting transmit power spectral density by controlling the transmit power of the terminal and using spread spectrum technology (selecting appropriate carrier bandwidths and spread factors); (ii) controlling the off-axis gain of the antenna along the GSO by inhibiting transmissions when the skew angle exceeds a specified threshold; and (iii) controlling pointing error to less than 0.2° (3-sigma) and inhibiting transmissions when the pointing offset exceeds a threshold of 0.35 degrees.[4]

When operating as described in the Application and with the off-axis EIRP density envelope as defined in the contract between Eutelsat and Panasonic, PAC's proposed operations are compliant with the off-axis EIRP density levels coordinated with neighboring satellites up to and including 6° separation in the geostationary orbit from the E172A satellite, and therefore will not cause unacceptable interference into these satellites.

Eutelsat confirms that the maximum downlink satellite EIRP density of 13 dBW/4KHz, which you have stated is the operational level of the Ku-band AMSS network operated by PAC, is consistent with Eutelsat's existing coordination agreements with adjacent satellite operators.

Based on the foregoing representations and affirmations by PAC, additional consultations between Eutelsat engineering staff and PAC, and more than a year of operation on the E172A satellite, Eutelsat hereby confirms the following:

---

[3] *See Revisions to Parts 2 and 25 of the Commission's Rules to Govern the Use of Earth Stations Aboard Aircraft Communicating with Fixed-Satellite Service Geostationary-Orbit Space Stations Operating in the 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.2 GHz and 14.0-14.5 GHz Frequency Bands; Service Rules and Procedures to Govern the Use of Aeronautical Mobile Satellite Service Earth Stations in Frequency Bands Allocated to the Fixed Satellite Service,* IB Docket Nos. 12-376 & 05-20, Notice of Proposed Rulemaking and Report and Order, FCC 12- 161 (rel. Dec. 28, 2012) ("ESAA Order").

[4] *See* Application at 5, 8-11 and Technical Appendix at 4-12.

1. Eutelsat is familiar with the represented technical characteristics of the PPA AES terminal.

2. Eutelsat has incorporated the power density levels contractually agreed between Eutelsat and Panasonic, for both uplink and downlink, into its current operational planning and coordination agreements with adjacent satellite operators for the E172A satellite at 172° E.L.

3. Eutelsat further advises that it is not aware of any cases of unacceptable interference relating to PAC's operation of the PPA AES from other customers operating on the E172A satellite or from adjacent satellite operators.

In sum, Eutelsat confirms that, if operated as described in the Application, as supplemented by PAC's representations and affirmations set forth above, operation of the PPA AES terminal will not cause unacceptable interference into other operations on E172A or adjacent satellites.

Please let me know if you require any further support from Eutelsat relative to PAC's operation of the PPA AES terminal on the E172A satellite.

Sincerely,

Ronald Samuel
Chief Executive Officer

Emissions Designators

Satellite and Beam Name	Tx/Rx	Emission Designator	Bandwidth (Hz)	Max EIRP (dBW)	ESD Limit (dBW/Hz) (From Link Budget)	ESD Limit (dBW/4Hz)	Max EIRP per Carrier (dBW) (FCC Entry)	Max EIRP per Carrier (dBW/4kHz)
E172A	Tx	500KG7D	500,000	48	-21.4	14.62	34.80	14.62
E172A	Tx	9M00KG7D	9,000,000	48	-21.4	14.62	47.35	14.62
E172A	Rx	1M20KG7D	1,200,000					
E172A	Rx	36M0KG7D	36,000,000					

Anik F1

Orbital Debris Plan

Anik F1 Satellite
End of Life Disposal and Debris Mitigation Plan

This statement is prepared by Telesat Canada ("Telesat") for the purpose of assisting its customer in meeting the requirements in relation to the end of life disposal and debris mitigation of a telecommunication satellite. This information addresses requirements contained in §25.114(d)(14)(i)-(iv) of the Commission's rules.

Debris Release Assessment. ANIK F1 was launched on November 21, 2000, and began commercial operations in February 2001. Boeing performed the orbit raising and deployments of the spacecraft using their then-current best practices in accordance with their normal operations and procedures for a 702 spacecraft..

Spacecraft Hardware Design: The Anik F1 spacecraft is a reliable Boeing 702 spacecraft which is designed to withstand the harsh space environment. This bus has demonstrated years of safe operational performance.

Accidental Explosion Assessment. Telesat has reviewed failure modes for all equipment to assess the possibility of an accidental explosion onboard the spacecraft. In order to ensure that the spacecraft does not explode on orbit Telesat will continue to operate the satellite in accordance with Boeing's recommended procedures. All batteries and fuel tanks are monitored for pressure or temperature variations. Alarms in the SCC (Satellite Control Center) inform controllers of any variations. Additionally, long term trending analysis will be performed to monitor for any unexpected trends.

Operationally, batteries are operated utilizing the manufacturer's automatic recharging scheme. Doing so ensures that charging terminates normally without building up additional heat and pressure. As this process occurs wholly within the spacecraft, it also affords protection from command link failures (on the ground).

In order to protect the propulsion system, fuel tanks are operated in a blow down mode. At the completion of orbit raising, the pressurant was isolated from the fuel system. This will cause the pressure in the tanks to decrease over the life of the spacecraft. This will also protect from a pressure valve failure that could cause the fuel tanks to become over-pressurized.

In order to ensure that the spacecraft has no explosive risk after it has been successfully de-orbited, all stored energy onboard the spacecraft will be removed. Upon successful de-orbit of the spacecraft, all propulsion lines and latch valves will be vented and left open. All battery chargers will be turned off and batteries will be left in a permanent discharge state. These steps will ensure that no buildup of energy can occur resulting in an explosion in the years after the spacecraft is de-orbited.

Assessment Regarding Collision with Larger Debris and Other Space Stations. Telesat has also assessed and limited the probability of the space station becoming a source of debris by collisions with large debris or other operational space stations.

Anik F1 operates in a collocated orbit with Anik F1R and (soon) Anik G1. Telesat will utilize industry standard, time proven techniques in the maneuvering of these collocated spacecraft. These are the same techniques that Telesat has and continues to use for its other collocated spacecraft.

In order to minimize the possibility of a large body impact collision, Telesat has assessed the proximity of other known Space Stations. In addition to working with all known neighbors, Telesat also utilizes three sources to identify collision risk. The first is alerts from the JSpOC for any approaching bodies. The second is the Space Data Center which utilizes our ephemeris as well as the ephemeris for all known bodies and provides us reports for potential collisions. The final is MIT/LL who utilizes its own radar and optical hardware to precisely provide data to Telesat for any close approach with debris.

Telesat continually monitors launch details to verify that no new spacecraft will take residence in the vicinity of the F1 spacecraft. In the event that some other spacecraft does locate within the vicinity of the F1 spacecraft, Telesat will work to coordinate orbits and station keeping strategies with the other spacecraft operators as it has done in the past with multiple other operators.

Post-Mission Disposal Plans. Anik F1, a Boeing built 702 bus, will be removed from its geostationary orbit at 107.3° W.L. at a perigee altitude no less than ~300 km above the standard geostationary orbit of 35786 km. This altitude was arrived at by using the FCC-recommended equation in §25.283 of the Commission's rules pertaining to end-of-life satellite disposal.

Minimum Deorbit Altitude= 235 km + (1000•CR•A/m) (Eq.1)
CR = solar pressure radiation coefficient of the spacecraft = 1.21
A/m = area to mass ratio, in square meters per kilogram, of the spacecraft = 0.0487

Result:
(Eq.1) Minimum Deorbit Altitude = 36,021 km + (1000·1.27•.0378) = 294 km

The propellant needed to achieve the minimum deorbit altitude is based on the delta-V required and specified by the spacecraft manufacturer.

Based on IADC calculation, an estimated end-of-life mass of 2700 kg, and the delta-V required, approximately 2 kg of propellant will be reserved to ensure minimum de-orbit altitude is obtained. It should be noted that F1 utilizes Xips thrusters (instead of normal Bi Prop). This means that Xenon is the basic fuel type (not Oxidizer (N204) and Fuel (MMH)). Xenon is much more efficient (which is why so little fuel is needed).

In addition to Xenon, there is also Oxidizer (N204) and Fuel (MMH) on board that was used during the orbit raising. In the event something happens to the Xenon system, it will be possible to de-orbit the spacecraft using the normal Fuel and Oxidizer.

Any remaining propellant will be consumed by further raising the orbit until combustion is no longer possible. The remaining species of Xenon propellant, Oxidizer (N204) or Fuel (MMH), will be vented, placing the propulsion system on the spacecraft in "safe" mode.

Propellant tracking is accomplished using a bookkeeping method. Using this method, the ground control station tracks the number of jet seconds utilized for station keeping, momentum control and other attitude control events. From jet seconds, amount of fuel used is determined. This process has been calibrated using data collected from thruster tests conducted on the ground and has been found to be accurate to within a few months of life on the spacecraft.

Eutelsat 10A

Coordination Letter

eutelsat
communications via satellite

Paris, 6th February 2013

Mark DeFazio
Manager, GCS Regulatory and Business Operations
Panasonic Avionics Corporation
26200 Enterprise Way
Lake Forest, CA 92630

Re: Application of Panasonic Avionics Corporation - Call Sign E100089, File No. SES- MFS-20120913-00818

Dear Mr. DeFazio,

In connection with Panasonic Avionics Corporation's ("PAC's") above-captioned application ("Application") to the Federal Communications Commission;[1] you have requested that Eutelsat confirm it has reviewed the technical characteristics of PAC's Ku-band aeronautical mobile-satellite service ("AMSS") operations with the Eutelsat 10A satellite ("E10A," formerly W2A). You would like Eutelsat to certify that such operations are consistent with Eutelsat's operations practice for the satellite and that, when operated in the prescribed manner, such operations do not result in unacceptable interference.

As set forth in the Application, the basic characteristics of the PAC phased-array ("PPA") aircraft earth station ("AES") terminal (referred to in the Application as the "Aura LE" terminal) for operation with the E10A satellite at 10°E.L. include:[2]

Antenna Dimensions	34.7 inches (0.88 m) 6.6 inches height (0.17 m)
Type of Antenna	Dual panel waveguide fed phased array
SSPA Rated Output Power	16 watts
Bandwidth	10.70 GHz to 12.75 GHz 14.0 GHz to 14.5 GHz
Transmit Gain	38 dBi
EIRP	48 dBW
Transmit Polarization	Horizontal or Vertical

[1] Application of Panasonic Avionics Corporation To Modify AMSS License To Permit Operation of Up to 2000 Technically Identical Aeronautical Mobile-Satellite Service ("AMSS") Aircraft Earth Stations ("AESs") in the 14.0-14.5 GHz and 10.7-12.75 GHz Frequency Bands, Call Sign E100089, File No. SES-MFS-20120913-00818 ("Application").

[2] *See id.* at 4.

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Receive G/T	10 to 14 dB/K
Transmit Azimuth Beamwidth	1.5 degrees
Transmit Elevation Beamwidth	4 degrees

We understand that the terminal is designed to comply with the FCC's rules and policies governing Ku-band earth stations onboard aircraft ("ESAAs") adopted in new Section 25.227 of the rules.[3]

You have advised Eutelsat that the PPA AES avoids interference to other satellite operations by limiting off-axis EIRP spectral density to no more than the levels specified here below, including: (i) limiting transmit power spectral density by controlling the transmit power of the terminal and using spread spectrum technology (selecting appropriate carrier bandwidths and spread factors); (ii) controlling the off-axis gain of the antenna along the GSO by inhibiting transmissions when the skew angle exceeds a specified threshold; and (iii) controlling pointing error to less than 0.2° (3 -sigma) and inhibiting transmissions when the pointing offset exceeds a threshold of 0.35 degrees.[4]

It is understood that the operation of the PPA AES will not result in an aggregated off-axis EIRP density levels that exceed those that would result from the following:

The off-axis EIRP in any 40 kHz band in the direction of an adjacent satellite shall not exceed the following values:

$31 - 25 \log \theta$ dBW for $2° < \theta < 7°$

+10 dBW for $7° < \theta < 9.2°$

$34 - 25 \log \theta$ dBW for $9.2° < \theta < 48°$

-8 dBW for $48° < \theta$

Where θ is the angle, in degrees, between the main-beam axis and the direction considered.

The levels indicated in this section apply for transmissions and from locations where the satellite receive system G/T is equal or lower than at beam edge (0 dB/K), the levels shall be decreased by the difference (in dB) between the satellite G/T in the direction of the earth station and the satellite G/T at beam edge.

When operating as described in the Application and with the associated aggregated off-axis EIRP density envelope as defined above, PAC's proposed aggregated operations are compliant with the

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[3] *See Revisions to Parts 2 and 25 of the Commission's Rules to Govern the Use of Earth Stations Aboard Aircraft Communicating with Fixed-Satellite Service Geostationary-Orbit Space Stations Operating in the 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.2 GHz and 14.0-14.5 GHz Frequency Bands; Service Rules and Procedures to Govern the Use of Aeronautical Mobile Satellite Service Earth Stations in Frequency Bands Allocated to the Fixed Satellite Service,* IB Docket Nos. 12-376 & 05-20, Notice of Proposed Rulemaking and Report and Order, FCC 12- 161 (rel. Dec. 28, 2012) ("ESAA Order").

[4] *See* Application at 5, 8-11 and Technical Appendix at 4-12.

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off-axis EIRP density levels requirements for potentially affected neighboring satellites up to and including 6° separation in the geostationary orbit off-axis from the E10A satellite, and therefore will not cause unacceptable interference into these adjacent satellites.

Based on the foregoing representations and affirmations by PAC, information included in the Application, additional consultations between Eutelsat engineering staff and PAC, and more than a year of operation on the E10A satellite, Eutelsat hereby confirms the following:

1. Eutelsat is familiar with the represented technical characteristics of the PPA AES terminal.

2. Eutelsat has incorporated power density levels as defined in this letter and currently operated, into its current operational planning with adjacent satellite operators for the E10A satellite at 10° E.L.

3. Eutelsat further advises that it is not aware of any cases of unacceptable interference relating to PAC's operation of the PPA AES from other customers operating on the E10A satellite or from adjacent satellite operators.

In sum, Eutelsat confirms that, if operated as described in the Application, as supplemented by PAC's representations and affirmations set forth above, operation of the PPA AES terminal will not cause unacceptable interference into other operations on E10A or adjacent satellites.

Please let me know if you require any further support from Eutelsat relative to PAC's operation of the PPA AES terminal on the E10A satellite.

Sincerely,

For Eutelsat
Jacques Dutronc
Chief Development and Innovation Officer

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Eutelsat 10A

Orbital Debris Plan

Eutelsat W2A/Eutelsat 10A Space Debris Mitigation Plan (prepared for the Federal Communications Commission)

ISSUE/REVISION: Issue 1, Rev. 0

ISSUE DATE: 20 December 2012

Prepared by:	*Position*	*Signature*	*Date*
D. Zamora	Head of Flight Dynamics		20/12/2012

Approved by:	*Position*	*Signature*	*Date*
L.R. Pattinson	Director of Satellite Operations		20/12/2012

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TABLE OF CONTENTS

1. Introduction

This document describes the space debris mitigation plan that Eutelsat shall apply to the **Eutelsat W2A/10A** space station.

Eutelsat W2A/10A is based on the Thales Alenia Space Spacebus 4000 bus and it was manufactured according to European standards and specifications. The satellite is 3-axis stabilised and uses bi-propellant chemical propulsion for attitude and on-station control.

Eutelsat W2A/10A was launched in 2009 and the end of its operational life is not expected to be before early 2023.

2. Related documents

2.1. Applicable Documents

1. EUTELSAT Space Debris Mitigation Plan. Issue 1.3. EUT_CTL-SAT_QMS_PLN_00021, 26 July 2010.
2. FCC. Orbital Debris Mitigation Standard Practices. FCC 04-130. June 21, 2004.

2.2. Reference Documents

1. European Code of Conduct for Space Debris Mitigation. Issue 1.0. 28 June 2004.
2. IADC Space Debris Mitigation Guidelines. IADC-02-01. Revision 1. September 2007.
3. Space Product Assurance. Safety. ECSS-Q-40A. 19 April 1996.
4. Orbital Debris Mitigation Standard Practices. FCC 04-130. 21 June 2004.
5. NASA Safety Standard. Guidelines and Assessment Procedures for limiting Orbital Debris. NSS 1740.14. Aug 1995.
6. ITU Environment Protection of the Geostationary Orbit. S.1003. 1993.
7. UNCOPUOS. Technical Report on Space Debris. 1999.

3. Eutelsat W2A/10A operations

- Eutelsat operates in order to control and limit the amount of debris released in a planned manner during normal operations, and assesses and limits 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.
- Eutelsat has assessed the amount of debris released in a planned manner and no intentional debris will be released during normal operations of the Eutelsat W2A/10A spacecraft. A safe operational configuration of the satellite system is ensured thanks to the hardware design and operational procedures

- Eutelsat minimizes the probability of the satellite becoming a source of debris by collisions with large debris or other operational satellites. Eutelsat assessed for Eutelsat W2A/10A whether there were any known satellite located at the requested orbital location or might overlap.
- Eutelsat W2A/10A is controlled within its ITU allocated orbit control window (10.0°E +/- 0.1°) by standard routine periodic orbit correction manoeuvres. In case of anticipated violation of the window, correction manoeuvres would be implemented to avoid such violation.
- Eutelsat has assessed the probability of accidental explosions during and after completion of mission operations. Thanks to design safety margins and enough safety barriers, the probability of occurrence of accidental explosion of the Eutelsat W2A/10A satellite is negligible.
- Satellite design is such that high levels of thruster activity and orbit perturbation do not result when foreseeable on-board events occur

4. Eutelsat W2A/10A End of life disposal

The post-mission disposal activities have been planned as follows:

1. The orbit of the satellite will be raised by 300 km in order to ensure that the spacecraft will not re-enter into the GEO protected region (GEO height +/- 200 km) in the long term. A mass of 16.7 kg of propellant have been allocated and reserved with a confidence level of 99% to carry-out the post-mission disposal manoeuvres. The FCC will be informed of any significant change to the above quantity of propellant.

   The minimum perigee height to avoid re-entering into the GEO protected region can be computed using the IADC formula applied to this satellite:

   $$\Delta H \text{ (km)} = 235 + 1000.(A/m)_{eff} = 278 \text{ km}$$

   where the final term is the effective area/mass ratio of the satellite. Therefore, the planned 300 km above GEO height is sufficient to satisfy the 278 km requirement.

   During the satellite lifetime, Eutelsat determine the remaining propellant tanks.

2. As part of the end of life activities Eutelsat W2A/10A energy sources will be rendered inactive, such that debris generation will not result from the conversion of energy sources on board the spacecraft into energy that fragments the satellite. For Eutelsat W2A/10A , this involves the following:

- depleting the chemical propulsion system, and where possible leaving open fuel lines and valves.

The following table shows the characteristics of the pressurant tank, propellant tanks and propellant lines at end of life (EOL). It shall be noted that during the passivation the four propellant tanks will be depressurised as much as possible.

Element	Total Volume (l)	Material contained at EOL	Predicted mass of material at EOL (kg)
MON-1 Propellant tank	1391	MON-1 He	12.1 2.8
MMH propellant tank	1391	MMH He	3.8 3.0
MON-1 lines MMH lines	0.65 0.65	MON-1 MMH	1.0 0.6
Pressurant tank 1	90	He	0.9
Pressurant tank 2	90	He	0.9

It shall be noted that the Lithium-Ion batteries mounted on this satellite can not be depressurised. Nevertheless, they have been designed with a security coefficient greater than 3 and the batteries are "leak before burst" designed.

The heatpipes, which use ammonia as working fluid, can not be depressurised either. They have been designed with a security coefficient greater than 4, the risk of break-up is considered negligible.

- leaving all batteries in a state of permanent discharge by isolation of the battery charge circuits and leaving certain loads connected to the batteries.

3. The satellite tracking, TM and TC usage are planned so as to avoid electrical interference to other satellites and coordinated with any potential affected satellite networks.
4. During the orbit raising manoeuvres the tracking, TM and TC frequencies will be limited to those where the satellite is authorized to operate.

The design of the Eutelsat 10A spacecraft, fully consistent with end of life ("EOL") passivation requirements as existed at the time of construction, does not allow passive venting once the spacecraft has been switched-off. Therefore, none of the elements that

appear on the previous Table can be vented over time once the spacecraft has been switched-off. Nevertheless, as part of the passivation of the spacecraft during the EOL operations, Eutelsat always makes best-efforts to vent the propellant remaining in the propellant tanks and lines as much as possible. The figures in the last column of the Table can be considered as worst-case post-passivation remaining mass, after final shut-down of the satellite. In any case, the pressurant tank is isolated just after the completion of the launch and early orbit phase ("LEOP") operations and it cannot be passivated as part of the EOL operations.

5. Notifications

EUTELSAT undertakes to provide the relevant bodies as required (UNCOPUOS, FCC, ITU, French ANFR, etc) with all appropriate notifications as required by law or regulations for Eutelsat satellites including but not limited to those concerning initial entry of service, location, relocations, inclined orbit operations and re-orbiting operations.