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

In the Matter of	)	
	)	
Eutelsat S.A.	)	File Nos.: SAT-PPL-20180302-00018
	)	and SAT-MPL-_____
Petition for Declaratory Ruling To	)	
Modify the U.S. Market Access Grant	)	Call Sign: S3031
of the EUTELSAT 133WA Satellite	)	

PETITON FOR DECLARATORY RULING

Eutelsat S.A. ("Eutelsat"), pursuant to Section 25.137(f) of the Commission's Rules,[1] hereby seeks to modify the U.S. market access grant of the French-licensed EUTELSAT 133WA Ku-band satellite.[2] The satellite has arrived at the nominal 133° W.L. orbital location and will soon commence commercial operations.[3] Eutelsat requests that the Commission authorize:

(i) repointing of the Fixed Beam to optimize its service area, including adjustment in the Pacific region to communicate with a gateway earth station located in Hawaii;

(ii) flexibility in pointing the Steerable 1 ("S1") Beam throughout the potential coverage area of the satellite in response to customer needs;

(iii) the provision of service using the 11.2-11.45 GHz (space-to-Earth) and 13.0-13.25 GHz (Earth-to-space) bands, subject to earth station operating authority;

(iv) the provision of service using the satellite's Steerable 2 ("S2") Beam, which includes 14.0-14.25 GHz (Earth-to-space) and 12.5-12.75 GHz (space-to-Earth) bands, the latter on a non-conforming basis in regions that do not conflict with other operations in the band and subject to earth station operating authority; and

(v) emergency back-up TT&C operations for the satellite using one uplink and one downlink channel in the S-band with an earth station located in Hawaii on a non-conforming basis.

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[1] *See* 47 C.F.R. §25.137(f).

[2] Eutelsat, S.A., *Grant of Petition for Declaratory Ruling*, File No. SAT-PPL-20180302-00018, Call Sign S3031 (August 16, 2018) ("*EUTELSAT 133WA Grant*").

[3] Given the existence of the U.S.-licensed Galaxy 15 satellite at 133°W.L., Eutelsat will operate the EUTELSAT 133WA satellite at 132.85° W.L. orbital location to avoid potential overlap of the satellites' station-keeping boxes.

The EUTELSAT 133WA satellite was recently added to the Permitted Space Station List ("Permitted List") to provide fixed-satellite service ("FSS") connectivity, including Ku-band mobility applications, in the U.S. market using the 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), and 13.75-14.5 GHz (Earth-to-space) bands.[4] The original EUTELSAT 133WA petition for declaratory ruling ("Original Petition") also included technical information relating to the 11.2-11.45 GHz and 13.0-13.25 GHz bands in the event that future earth station applicants seek to operate with EUTELSAT 133WA in these bands, subject to appropriate earth station operating authority and compliance with applicable Commission rules and policies.[5]

The EUTELSAT 133WA satellite has reached its assigned orbital location and is expected to commence operations in September 2018. Over the past several months, there has been significant interest in additional satellite capacity at the nominal 133°W.L. orbital location, particularly for Ku-band mobility applications such as earth stations aboard aircraft ("ESAAs'"). Eutelsat seeks to modify the EUTELSAT 133WA market access grant to further enhance the satellite's operational flexibility and transponder capacity to provide such services.

The information in this Petition, including schedules and attachments, demonstrates that the proposed adjustments to the EUTELSAT 133WA satellite's currently authorized operations comply with Commission rules and policies (including eligibility for appropriate rule waivers). For the reasons discussed herein, grant of this petition would strongly serve the public interest.

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[4] *See EUTELSAT 133WA Grant* (note the Permitted List and Approved Space Station List have not yet been updated to reflect this grant).

[5] *See* Petition for Declaratory Ruling to Access the U.S. Market and To Be Added to the Permitted Space Station List at the Nominal 133°W.L Orbital Location, File No. SAT-PPL-20180302-00018 (Call Sign S3031) ("*Original Petition*") at 8 and Attachment C (Engineering Statement), Section 14.

I. DISCUSSION

Eutelsat files the instant Petition pursuant to Section 25.137(f) of the Commission's Rules,[6] which contemplates modification of U.S. market access grants consistent with license modification provisions.[7] Section 25.117(d) provides that applications for modification of space station licenses need to include only those items that have changed,[8] and that such applications will be granted unless a grant would not serve the public interest, convenience, and necessity.[9]

Eutelsat's Petition satisfies the requirements for grant. Eutelsat provides information required by Section 25.114 that has changed (including new beam pointing, frequency and spectrum compatibility information), demonstrates that the requested changes are consistent with Commission rules and policies, and certifies that there has been no change to the remaining information included in the Original Petition.[10] Eutelsat also demonstrates that granting the requested modification of its market access grant would serve the public interest.

A. Fixed Beam Repointing

The EUTELSAT 133WA satellite's Ku-band Fixed Beam was initially configured to cover the Contiguous United States ("CONUS") and Alaska.[11] Eutelsat proposed to repoint its Fixed Beam to cover Hawaii and western CONUS in order to optimize its service area and to enable communications with a new gateway earth station at a Hawaii teleport serving multiple Eutelsat satellites.[12] Fixed Beam orientation will be adjusted by reorienting the spacecraft bus.

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[6] *See* 47 C.F.R. §25.137(f).

[7] *See* 47 C.F.R. §25.117(d)(1).

[8] *See id., see also* 47 C.F.R. §25.114.

[9] *See* 47 C.F.R. §25.117(d)(2).

[10] *See* Attachment A. Note also that the Eutelsat ownership information submitted with the Original Petition remains unchanged. *See Original Petition* at Attachment A.

[11] *See id.,* Engineering Statement at Section 3 and Exhibit 3.

[12] The Fixed Beam's updated service area is depicted in the attached Engineering Statement.

Because the Fixed Beam includes only conventional Ku-band and Appendix 30B Ku-band frequencies operating at same power levels as in Original Petition (the latter of which can be used only pursuant to appropriate earth station operating authority), this adjusted service area will have no material impact on the interference environment compared to the one presented in Original Petition. Grant of the requested pointing adjustment will create significant operational efficiencies by allowing Eutelsat to access a Hawaii teleport serving other satellites in its fleet and enhance the satellite's coverage in areas of highest customer demand.

B. Reorientation and Flexibility in Steerable 1 Beam Pointing

The EUTELSAT 133WA satellite's S1 Beam was initially configured to cover the Contiguous United States ("CONUS").[13] Eutelsat seeks to reorient the S1 Beam to cover the remainder of CONUS and the Caribbean region not covered by the Fixed Beam and, as discussed below, flexibility to adjust beam pointing in the future to respond to changes in customer requirements.[14] Reorientation of the beam will be accomplished by repointing and rotating the S1 gimballed satellite antenna, which is designed to steer all over the visible Earth and which is rotatable by +/-90°.[15]

Eutelsat also requests operational flexibility to adjust the pointing of the S1 Beam within the EUTELSAT 133WA satellite's coverage area to optimize service to customers consistent with Section 25.114(c)(4)(vi)(D) of the Commission's Rules. Because the S1 Beam includes only conventional Ku-band frequencies operating at same power levels as in Original Petition, pointing flexibility will not adversely impact other spectrum users but will afford Eutelsat the

[13] *See Original Petition*, Engineering Statement at Section 3 and Exhibit 3.

[14] The S1 Beam's service area and coverage area are depicted in the attached Engineering Statement.

[15] Identification of gateway earth station to support the S1 Beam will occur in due course and depends on actual S1 Beam pointing.

ability to respond to changes in customer requirements and better satisfy market demand for Ku-band mobility services.

C. Explicit Inclusion of the 11.2-11.45 GHz and 13.0-13.25 GHz Bands in the EUTELSAT 133WA Grant

Eutelsat respectfully requests the Commission to explicitly include in the EUTELSAT 133WA market access grant the 11.2-11.45 GHz (space-to-Earth) and 13.0-13.25 GHz (Earth-to-space) frequency bands, which are part of the FSS "planned bands" subject to the provisions of Appendix 30B of the International Telecommunication Union ("ITU") Radio Regulations. The Original Petition focused on adding EUTELSAT 133WA to the Permitted Space Station List ("Permitted List") in appropriate frequencies, but also included a showing with respect to operations in the 11.2-11.45 GHz and 13.0-13.25 GHz bands should future earth station applicants seek to operate with EUTELSAT 133WA in these bands.[16] The minor adjustment to Fixed Beam pointing does not impact the information provided in the Original Petition, which establishes that no U.S. allotments or assignments are adversely affected by the operation of EUTELSAT 133WA at the nominal 133°W.L. orbital location.

Eutelsat understands that explicit inclusion of the 11.2-11.45 GHz and 13.0-13.25 GHz bands is not a prerequisite for an earth station applicant to request authority to communicate with EUTELSAT 133WA in these frequencies.[17] Nonetheless, other satellites have specifically sought market access for Appendix 30B bands and such authority has been included in their market access grants and indicated in the Commission's list of approved space stations.[18] In the

[16] *See supra* note 5.

[17] Becoming an authorized point of communication of a U.S.-licensed earth station confers authority for a foreign-licensed satellite to serve the U.S. market. *See* 47 C.F.R. §25.137.

[18] *See, e.g.*, https://www.fcc.gov/approved-space-station-list.

interest of clarity and out of an abundance of caution, Eutelsat seeks similar inclusion of the 11.2-11.45 GHz and 13.0-13.25 GHz bands in the EUTELSAT 133WA Grant.

D. Authority to Operate the Steerable 2 Beam in the Hawaii/Pacific Region

The EUTELSAT 133WA satellite's Steerable 2 ("S2") Beam was originally intended to be used only outside the United States for traditional FSS services. Therefore, Eutelsat did not initially request authority to operate the beam in the United States or with U.S.-licensed mobility earth stations operating outside the United States.[19] Given increased demand for EUTELSAT 133WA capacity occasioned by the arrival of the satellite on-station, particularly for Ku-band mobility services, Eutelsat now respectfully seeks U.S. market access for the S2 Beam.

The S2 Beam includes the 14.0-14.25 GHz (Earth-to-space) and 12.5-12.75 GHz (space-to-Earth) bands. Eutelsat currently seeks to operate this steerable beam in the Hawaii/Pacific region to utilize the Hawaii teleport serving other beams on EUTELSAT 133WA and other Eutelsat satellites. Eutelsat also requests operational flexibility in the future to adjust the pointing of the S2 Beam within those portions of satellite's coverage area that do not conflict with other authorized operations to optimize service to customers consistent with Section 25.114(c)(4)(vi)(D) of the Commission's Rules.[20]

The 14.0-14.25 GHz band is allocated to FSS uplinks on a primary basis and other space services on a secondary basis. Eutelsat demonstrated compatibility of EUTELSAT 133WA uplink operations in the Original Petition assuming co-frequency, co-coverage operation of adjacent satellites. Thus, the prior compatibility analysis applies equally to the S2 Beam. Eutelsat provides new link budgets for the S2 Beam in the attached Engineering Statement.

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[19] *See Original Petition,* Engineering Statement at note 1.

[20] The S2 Beam's service area and coverage area are depicted in the attached Engineering Statement. Reorientation of the beam will be accomplished by repointing and rotating the S2 gimballed satellite antenna, which is designed to steer all over the visible Earth and which is rotatable by +/-90°.

The 12.5-12.7 GHz downlink band is allocated to terrestrial fixed ("FS") and Broadcast Satellite Service ("BSS"), and the 12.7-12.75 MHz downlink band to FS, Mobile Service ("MS") and FSS (Earth-to-space). As discussed more fully in the attached Technical Description and Schedule S information, Eutelsat will operate in the S2 Beam's downlink spectrum consistent with PFD limits applicable to FSS operations in Region 1 and 3 in the 12.5-12.75 GHz band and designed to protect co-frequency terrestrial services.[21] In addition, Eutelsat has carefully examined the potential impact of its proposed FSS downlinks in the 12.5-12.7 GHz band on U.S. Direct Broadcast Satellite ("DBS") operations.[22] Frequency diversity, geographic separation between the S2 Beam and DBS downlink beams, and orbital spacing between EUTELSAT 133WA and authorized DBS satellites allow S2 Beam downlinks to operate in large portions the Hawaii/Pacific region without causing harmful interference into DBS earth station receivers. Thus, Eutelsat can be authorized to operate the S2 Beam on a non-conforming (unprotected, non-harmful interference) basis.[23]

Grant of authority to operate the S2 Beam, including downlink operations in the 12.5-12.75 GHz band, would enhance Eutelsat's capabilities to provide advanced Ku-band mobility services in the Hawaii/Pacific region. Access to this beam will add 250 megahertz of spectrum for such services and expand the geographic coverage of EUTELSAT 133WA. In addition, authorizing operation of the S2 Beam would enable the use of spectrum and orbital resources that would otherwise remain fallow. These public interest benefits can be realized without causing harmful interference to U.S.-licensed satellite and terrestrial systems.

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[21] *See* Engineering Statement and Schedule S; *see also* ES 172 LLC, Space Station Authorization, File No. SAT-RPL-20170927-00136, Call Sign S3021 (reissued Sept. 5, 2018) at Frequencies and Conditions 3 and 4 (authorizing access to the 12.2-12.7 GHz and 12.7-12.75 GHz bands on a non-interference basis subject to conditions).

[22] *See* Engineering Statement at Sections 15 and 16.

[23] *See* Section I.F, *infra*, for associated waiver request.

E. Authority to Operate Emergency Back-Up TT&C in S-Band Frequencies with an Earth Station in Hawaii

In the attached Engineering Statement and Schedule S, Eutelsat provides information regarding the omni Back-Up TT&C Beam on the EUTELSAT 133WA satellite. This information was not included in the Original Petition because no TT&C operations in the band were contemplated from the United States, but Eutelsat is now obtaining emergency back-up TT&C support from an earth station located in Paumalu, Hawaii.[24]

Eutelsat seeks to operate small uplink and downlink channels in specific S-band frequencies on an emergency back-up basis only, with additional pre-scheduled tests to be conducted on a semi-annual basis to ensure continuing TT&C link functionality. Eutelsat acknowledges that authority for these limited, emergency back-up TT&C operations requires a waiver[25] and would be subject to grant of appropriate earth station operating authority, including compliance with any conditions imposed therein.

F. Waiver Requests

Eutelsat requests waivers of certain Commission rules in the context of this Petition. The Commission has authority to grant waivers of its rules for "good cause shown."[26] In general, good cause exists if grant of a waiver would not undermine the purposes of the rule and would otherwise serve the public interest. In determining whether waiver is appropriate, the Commission should "take into account considerations of hardship, equity, or more effective

[24] *See* Intelsat License LLC, File No. SES-STA-20180711-01659 (granted Aug. 21, 2018).

[25] *See* Section I.F, *infra,* for associated waiver request.

[26] *See* 47 C.F.R. §1.3; *WAIT Radio v. FCC,* 418 F.2d 1153, 1159 (D.C. Cir. 1969).

implementation of overall policy."[27] As discussed below, compelling reasons exist to grant the requested waivers in connection with this Petition to modify the EUTELSAT 133WA Grant.

1. Waiver of Section 2.106 To Permit FSS Downlink Operations in the 12.5-12.75 GHz Band

Eutelsat proposes to operate the EUTELSAT 133WA S2 Beam in the 12.5-12.75 GHz downlink band and the beam's proposed coverage area overlaps portions of ITU Regions 1, 2, and 3. Under the U.S. Table of Frequency Allocations, the 12.5-12.7 GHz band has a primary allocation for BSS and terrestrial fixed microwave services in the United States, and additional primary allocations for certain terrestrial services elsewhere in Region 2. However, No. 5.492 of the ITU Radio Regulations, included in the U.S. Table of Frequency Allocations, contemplates the potential for FSS downlink operations in this band.[28] The 12.7-12.75 MHz downlink band is allocated to FS, MS and FSS (uplinks) in Region 2, and Regions 1 and 3 have a primary allocation for FSS downlinks across the entire 12.5-12.75 GHz band.

Eutelsat requests that the Commission grant a waiver permitting EUTELSAT 133WA to operate in the 12.5-12.75 GHz band in the Hawaii/Pacific region on an unprotected, non-harmful interference basis as a non-conforming use. BSS earth stations receive downlink transmissions in the 12.5-12.7 GHz band use directional antennas and the attached Engineering Statement establishes that the S2 Beam can operate on a non-interference basis with BSS downlinks in the

[27] *WAIT Radio*, 418 F.2d at 1159.

[28] No. 5.492 provides: "Assignments to stations of the broadcasting-satellite service which are in conformity with the appropriate regional Plan or included in the Regions 1 and 3 List in Appendix 30 may also be used for transmissions in the fixed-satellite service (space-to-Earth), provided that such transmissions do not cause more interference, or require more protection from interference, than the broadcasting-satellite service transmissions operating in conformity with the Plan or the List, as appropriate." *See* 47 C.F.R. §2.106.

12.5-12.7 GHz band by taking advantage of frequency diversity, geographic beam separation and orbital separation between EUTELSAT 133WA and authorized DBS/BSS satellites.[29]

There is also little potential for interference with non-geostationary satellite orbit ("NGSO") FSS systems that may operate in the 12.5-12.7 GHz band.[30] Currently, there are no NGSO FSS systems operating in this band, although the FCC has authorized the OneWeb system to use the band.[31] EUTELSAT 133WA downlink operations comply with PFD limits applicable to the 12.5-12.7 GHz band in other ITU regions and are consistent with No. 5.492 of the ITU Radio Regulations;[32] and Eutelsat understands that the OneWeb system complies with PFD and EPFD limits applicable to its NGSO FSS operations. Through mutual compliance with these limits, the operations of the EUTELSAT 133WA satellite and the OneWeb system will be compatible in this downlink band.

In the 12.7-12.75 GHz band, the EUTELSAT 133WA satellite will operate consistent with PFD limits designed to fully protect terrestrial operations. In addition, Eutelsat seeks to operate only mobility links in this band segment,[33] so there is no expectation or need for any protection for these operations. Accordingly, authority to operate in the 12.7-12.75 GHz band can be granted without adversely affecting existing or future terrestrial use if the band.

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[29] *See* Engineering Statement at Sections 15 and 16.

[30] Pursuant to No. 5.487A of the ITU Radio Regulations, included in the U.S. Table of Frequency Allocations, 47 C.F.R. §2.106, there is an additional primary allocation to FSS in the 11.7-12.5 GHz band in Region 1, and in the 12.2-12.7 GHz band in Region 2, limited in each case to NGSO systems.

[31] *See* WorldVu Satellite Limited, Order and Declaratory Ruling, IBFS File No. SAT-LOI-20160428-00041, Call Sign S2963 (rel. June 23, 2017).

[32] No. 5.492 of the ITU Radio Regulations contemplates FSS operations in the band "provided that such transmissions do not cause more interference, or require more protection from interference, than the broadcasting-satellite service transmissions operating in conformity with the Plan or the List, as appropriate."

[33] Gateway downlink operations for the S2 Beam will be conducted in the 12.5-12.7 GHz band only.

The EUTELSAT 133WA satellite's proposed use of the 12.5-12.75 GHz band is both unique and limited. The S2 Beam includes these frequencies because EUTELSAT 133WA originally operated in Region 1 where the band is allocated for FSS downlinks and was recently relocated to the nominal 133˚ W.L. orbital location. The proposed use of the band is possible on an unprotected, non-interference basis and will allow valuable spectrum and orbital resources to be utilized for advanced mobility services rather than lying fallow. Moreover, the proposed use is time-limited because EUTELSAT 133WA is an aging satellite that is authorized to operate at 133˚ W.L. only until deployment of the U.S.-licensed Galaxy 15R satellite.

Eutelsat would also note that the Commission recently authorized the EUTELSAT 172B satellite to operate in the 12.5-12.75 GHz band on a non-interference basis subject to appropriate conditions,[34] which Eutelsat acknowledges and accepts would apply to EUTELSAT 133WA operations as well. As with EUTELSAT 172B and other satellites authorized to operate in this spectrum,[35] the EUTELSAT 133WA satellite should be permitted to conduct downlink operations in the 12.5-12.75 GHz band on a non-interference basis in the S2 Beam coverage area identified herein.

2. Waiver of Section 2.106 To Permit Emergency Back-Up TT&C and Limited Test Operations

The U.S. Table of Frequency Allocations allocates the 2025-2100 MHz band for Fixed, Mobile, and Federal use. The 2200-2290 MHz is allocated to Federal services (Space Operations, Earth Exploration Satellite Service, Fixed, Mobile, and Space Research). In order to enable emergency back-up TT&C operations using the EUTELSAT 133WA satellite's omnidirectional TT&C antenna, as well as limited pre-scheduled link testing, Eutelsat requests waiver of the U.S.

[34] *See supra* note 21.

[35] *See* https://www.fcc.gov/approved-space-station-list (authorized frequencies).

Table of Frequency Allocations to permit the satellite to communicate with a TT&C earth station located in Paumalu, Hawaii.

Good cause exists to waive the U.S. Table of Allocations for the limited emergency back-up TT&C operations proposed herein. The EUTELSAT 133WA satellite is designed with back-up TT&C in S-band frequencies, consistent with the allocation of ITU Region 1 where the satellite previously operated. Because the spacecraft is in orbit, it is not possible to change these TT&C frequencies.

In addition, use of the proposed bands would only be for a few hours per year or if there is an anomaly with the satellite. In the event an anomaly occurs, all efforts will be made to immediately regain use of the Ku-band TT&C capabilities. Eutelsat also notes that is possible to notify/coordinate with potentially affected spectrum users to ensure there is no potential for harmful interference from the proposed operations, particularly with respect to intermittent TT&C link testing.[36]

Because emergency back-up TT&C services for the EUTELSAT 133WA satellite are essential to ensure safe station-keeping and operation of the satellite, grant of the requested waiver will serve the public interest. At the same time, granting a waiver in the unique circumstances of the request, including the very limited use of these frequencies on a non-interference basis to support emergency back-up TT&C operations and intermittent link testing for a relocated satellite that will operate at the 133˚ W.L. orbital location for an interim period only, will not undermine the purposes of the rule.

[36] Extensive notification, coordination and other conditions have been adopted to permit the Paumalu, Hawaii TT&C earth station to conduct initial TT&C operations with EUTELSAT 133WA in the subject bands. *See* Intelsat License LLC, File No. SES-STA-20180711-01659 (granted Aug. 21, 2018). Eutelsat acknowledges that further authority for such operations will be subject to additional U.S. government coordination and conditions.

II. CONCLUSION

For the foregoing reasons, Eutelsat respectfully requests the Commission to grant its requests to repoint the EUTELSAT 133WA satellite's Fixed Beam to optimize its service area and communicate with a new gateway in Hawaii; to authorize flexibility in pointing the S1 Beam throughout the coverage area of the satellite; to formally include the 11.2-11.45 GHz and 13.0-13.25 GHz bands in the EUTELSAT 133WA market access grant; to authorize the provision of service using the satellite's S2 Beam, including the 14.0-14.25 GHz uplink and 12.5-12.75 GHz downlink bands; and to permit emergency back-up TT&C and limited link testing operations in certain S-band channels. Authorizing these modifications will enhance the ability of the EUTELSAT 133WA satellite to provide advanced Ku-band mobility and other services to U.S. customers in furtherance of the public interest.

ATTACHMENT A

CERTIFICATION OF EUTELSAT S.A.

As required by 47 C.F.R. §25.117(d), Eutelsat S.A. has submitted information relating to proposed modifications to the authorized operating parameters of the EUTELSAT 133WA satellite and certifies that the remaining information submitted to the Commission with respect to EUTELSAT 133WA operations has not changed.

Jacques Dutronc
Chief Development & Innovation Officer
Eutelsat S.A.

September 8, 2018

ATTACHMENT B – REGULATORY COMPLIANCE MATRIX

Reference	Reference Location	Topic / Reason for (n/a)
25.114(a)(1)	FCC Form 312, Schedule S, Attachment C	Overall context of filing
25.114(a)(2)	n/a	NGSO constellation
25.114(a)(3)	n/a	Application filed pursuant to two-step procedure
25.114(b)	FCC Form 312	47 U.S.C §304 Waiver (if applicable)
25.114(c)(1)	FCC Form 312	Applicant information
25.114(c)(2)	FCC Form 312; Narrative, Attachment C and Schedule S	Contact information
25.114(c)(3)	Schedule-S	Type of authorization
25.114(c)(4)(i)	Schedule-S	Channel frequency, bandwidth and polarization
25.114(c)(4)(ii)	Schedule-S	Maximum EIRP and EIRP density of TX beams
25.114(c)(4)(v)	Schedule-S	RX beam: G/T, SFD
25.114(c)(4)(vi)(A)	Schedule-S	GSO: Antenna Gain Contours
25.114(c)(4)(vi)(B)	n/a	NGSO: Antenna Gain Contours
25.114(c)(4)(vi)(C)	n/a	Shapeable Beams: Antenna Gain Contours
25.114(c)(4)(vi)(D)	Narrative, Attachment C - Section 2 and Exh. 2	Steerable, non-shapeable beams
25.114(c)(4)(vii)(A-C)	n/a	GSO: Large number of spot beams
25.114(c)(5)(i-v)	Schedule-S	GSO: Orbital parameters
25.114(c)(6)(i-ix)	n/a	NGSO: Orbital parameters
25.114(c)(7)	Schedule-S, Attachment C – Sections 2, 3 and 6 and Exhibit 2	Frequency Bands, Types of Service and Coverage Areas
25.114(c)(8)	Schedule-S, See 25.208	TX Beams: PFD
25.114(c)(10)	Schedule-S	Operational Lifetime
25.114(c)(11)	Schedule-S	Common Carrier Status
25.114(c)(13)	n/a	17/24 GHz BSS polarization isolation
25.114(d)(1)	Narrative, Attachment C - Section 2	Overall description
25.114(d)(6)	Narrative	Public Interest
25.114(d)(7)	See 25.140(a)	Interference Analysis
25.114(d)(8)	n/a	L-Band MSS
25.114(d)(9)	n/a	MSS: Multiple Satellites
25.114(d)(10)	n/a	L/S-Band MSS
25.114(d)(11)	n/a	DBS
25.114(d)(12)	n/a	NGSO FSS
25.114(d)(13)(i-ii)	n/a	DBS
25.114(d)(14)(i-v)	n/a	Orbital Debris
25.114(d)(15)(i-v)	n/a	17/24 GHZ BSS
25.114(d)(16)	n/a	17/24 GHZ BSS
25.114(d)(17)	n/a	17/24 GHZ BSS
25.114(d)(18)	n/a	17/24 GHZ BSS

Reference	Reference Location	Topic / Reason for (n/a)
25.117(d)	FCC Form 312, Schedule S, Attachment C, Narrative	Modifications
25.137(a)	n/a (Original Petition)	Requirements for U.S. market access request
25.137(b)	n/a (Original Petition)	Legal and technical information required for U.S. market access
25.137(c)	n/a (Original Petition)	Queue placement
25.137(d)	n/a (Original Petition)	Non-U.S.-licensed satellite requirements
25.137(f)	Narrative and Attachments	US Market Access modifications
25.140(a)(2)	n/a (Original Petition)	Less than two-degree spacing
25.140(a)(3)(i)	n/a	C-band limits
25.140(a)(3)(ii)	Attachment C - Section 14; see also Sections 15 and 16 (12.5-12.7 GHz compatibility analyses)	Ku-band limits
25.140(a)(3)(iii)	n/a	Ka-band limits
25.140(a)(3)(iv)	Attachment C - Section 14	AP30B limits
25.140(a)(3)(v)	n/a	2-degree spacing interference analysis
25.140(d)	n/a	Non-routine transmission levels
25.156(a)	Narrative	Application consideration - general
25.158	Narrative – Part II, Section C	Application consideration - GSO
25.159	n/a	Unbuilt systems
25.172(a)(1-4)	Attachment C – Section 4	TT&C Reporting
25.202(e)	Attachment C - Section 7	Frequency Tolerance
25.202(f)(1-3)	Attachment C - Section 8	Out of band emissions
25.202(g)	n/a	TT&C on band edge
25.207	Attachment C - Section 10	Cessation of Emissions
25.208(a-g)	Attachment C - Section 12	PFD Analysis
25.210(f)	Attachment C - Section 9	Full Frequency Reuse
25.210(j)	n/a	EW Station keeping tolerance
25.283(a-c)	n/a	End-of-life Disposal
25.207	Attachment C - Section 10	Cessation of Emissions

ATTACHMENT C- ENGINEERING STATEMENT

1. Scope

As required by Sections 25.114, 25.117(d), 25.137(f) and other sections of the Part 25 rules, this Attachment contains additional information that cannot be entered into the Schedule S online submission system and other explanatory information regarding the proposed modification of authorized operations of the EUTELSAT 133WA satellite at the nominal 133° W.L. orbital location. The fundamental technical and operational characteristics of the EUTELSAT 133WA satellite are outlined in the original market access request for the satellite filed by Eutelsat S.A. (the "Original Petition") and recently granted by the Federal Communications Commission ("FCC" or "Commission"). *See* File No. SAT-PPL-20180302-00018, Call Sign S3031 (granted Aug. 16, 2018) ("EUTELSAT 133WA Grant").

This document provides information about orientation adjustments to the satellite's Ku-band fixed ("Fixed") and Steerable 1 ("S1") Beams, as well as information regarding the additional Steerable 2 ("S2") Beam and S-band Back-Up TT&C Beam ("Back-Up TT&C Beam") used for emergency restoration TT&C and limited link testing. In addition, this document provides additional PFD analyses, link budgets, service and coverage area maps, and compatibility analyses of the new S2 Beam.

2. General Description

The EUTELSAT 133WA satellite will provide fixed-satellite service ("FSS") and mobility services in the United States and other markets from the nominal 133° W.L. orbital location.[1] The satellite has arrived at its operational location and will provide interim service at this orbital location pending deployment of the authorized Galaxy 15R satellite. EUTELSAT 133WA will begin commercial operations at the nominal 133° W.L. orbit location in September 2018.

The EUTELSAT 133WA satellite has one regional fixed Ku-band beam (the Fixed Beam) and two steerable Ku-band beams (the S1 and S2 Beams), as well as an emergency back-up S-band TT&C omni beam (the Back-Up TT&C Beam). The Fixed Beam will be configured to cover the western Contiguous United States (CONUS) plus the state of Hawaii. The S1 Beam will cover the remainder of CONUS and the Caribbean region and may be repointed within the satellite's coverage area. The S2 Beam will be employed over Hawaii and the Pacific Ocean and may be repointed, subject to protecting co-frequency Direct Broadcast

[1] The satellite will actually operate at 132.85° W.L. to avoid overlap of its station-keeping box with that of the Galaxy 15 satellite located at 133.0° W.L., but the Schedule S rounds the orbital location to 133° W.L.

Satellite ("DBS") downlinks from harmful interference. The service and coverage areas of these beams are described more fully in Exhibit 2.

Although primary TT&C operations are conducted in Ku-band frequencies as described in the Original Petition, the EUTELSAT 133WA satellite includes an emergency back-up TT&C omni beam. The Back-Up TT&C Beam will cover the visible Earth. Information regarding the Back-Up TT&C Beam was not included in the Original Petition because no TT&C operations in the band were contemplated from the United States, but Eutelsat is now obtaining emergency back-up TT&C support from an earth station located in Paumalu, Hawaii. Back-Up TT&C Beam information is submitted herein to support future requests for authority for that earth station to communicate with EUTELSAT 133WA.

3. Ku-Band S2 Beam

In addition to the beams included in the Original Petition, the satellite will also operate the S2 in Ku-band at the frequencies listed below:

Ku-band Uplink	**Ku-band Downlink**
14.0 – 14.25 GHz	12.5 – 12.75 GHz

EUTELSAT 133WA provides the following coverage (illustrations of the beam coverage areas are provided in Exhibit 2):

Ku-band Uplink	Steerable S2	Hawaii/Pacific Ocean
Ku-band Downlink	Steerable S2	Hawaii/Pacific Ocean

4. Back-Up Telemetry, Tracking and Control (TT&C)

Primary TT&C operations in the Ku-band for the EUTELSAT 133WA satellite were described in the Original Petition. The emergency back-up TT&C sub-system provides for communications during spacecraft emergencies and orbit transfer. S-band telecommand transmissions are normally received and S-band telemetry communications are normally transmitted by the spacecraft through a near omni-directional antenna.

The satellite will utilize a single S-band telemetry channel and a single S-band command channel at the nominal 133˚ W.L. orbital location. The S-band telemetry channel center frequency is 2265.0 MHz with a bandwidth of 300 kHz, and the S-band command channel center frequency is 2085.688 MHz with a bandwidth of 400 kHz. TT&C operations will be conducted from earth station facilities located in Hawaii.

The Back-Up TT&C Beam is used for orbital maneuvers and on-station emergencies and has gain contours that vary by less than 8 dB across the surface of the Earth. Accordingly, the gain at 8 dB below the peak falls beyond the edge of the Earth. Therefore, pursuant to Section 25.114(c)(4)(vi)(A) of the Commission's rules, contours for these beams are not required to be provided and the associated GXT files have not been included in Schedule S.

In addition to the Eutelsat contact information previously provided, emergency contact information for the back-up TT&C earth station includes:

Address:
Paumalu Teleport
Comsat Road
Haleiwa, HI 96712

Telephone:
(703) 559-7701 (primary)
(310) 525-5591 (back-up)

Information regarding associated TT&C earth station operations and conditions of the limited communications proposed in the subject frequencies can be found on the FCC's International Bureau Filing System, File No. SES-STA-20180711-01659, and such additional application material as may be filed by the TT&C earth station operator.

5. Uplink Power Control

Uplink power control operations for the EUTELSAT 133WA satellite were described in the Original Petition. The description also applies to operation of the S2 Beam.

6. Frequency Plan

6.1 Ku-Band

In addition to the channels filed the Original Petition, the following tables list the uplink and downlink Ku-band channel plan for the S2 Beam of EUTELSAT 133WA. This information is also provided in the accompanying Schedule S but is included here for clarity. The transponder channels can be used in any configuration for either gateway links or mobility terminal links. However, the portion of downlink spectrum above 12.7 GHz on the channel at 12708.33 MHz will only be used for mobility links to avoid any potential for constraining future terrestrial use of the 12.7-12.75 GHz band.

Table 1 Ku-Band Downlink Frequency Plan

Channel ID	Bandwidth (kHz)	Center Frequency (MHz)	Polarization
DF1	72000	12541.67	H
DF2	72000	12541.67	V
DF3	72000	12625	H
DF4	72000	12625	V
DF5	72000	12708.33	H
DF6	72000	12708.33	V

Table 2 Ku-Band Uplink Frequency Plan

Channel ID	Bandwidth (kHz)	Center Frequency (MHz)	Polarization
UF1	72000	14041.67	V
UF2	72000	14041.67	H
UF3	72000	14125	V
UF4	72000	14125	H
UF5	72000	14208.33	V
UF6	72000	14208.33	H

7. Frequency Tolerance

Section 25.202(e) requires that the carrier frequency of each space station transmitter be maintained within 0.002% of the reference frequency. These frequency tolerance requirements will be met.

8. Out of Band Emissions

The out-of-band emission limits of Section 25.202(f)(1), (2) and (3) will be met.

9. Frequency Reuse

EUTELSAT 133WA employs full frequency reuse on the Ku-band uplink and downlink by employing dual orthogonal linear polarization and frequency reuse across multiple fixed and steerable beams.

10. Cessation of Emissions

As required by Section 25.207 of the FCC's rules, all downlink transmissions can be turned on and off by ground telecommand, thereby causing cessation of emissions from the satellite.

11. ITU Filings

The satellite will operate the S2 Beam in the 12.5-12.75 GHz and 14.0-14.25 GHz bands at the nominal 133° W.L. orbital location under the F-SAT-N4-133W ITU satellite network filings. The operation of the S2 Beam will fall within the envelope of the parameters disclosed in these ITU satellite network filings.

12. PFD Analysis

The Commission's rules do not specify a PFD limits in the 2200-2300 MHz band; however, there are PFD limits specified in rule No. 21.16 of the International Telecommunication Union ("ITU") Radio Regulations. Neither the Commission's rules nor rule No. 21.16 of the International Telecommunication Union ("ITU") Radio Regulations specify a PFD limit for FSS in the 12.5-12.75 GHz band in Region 2. However, No.21.16 does specify PFD limits for the 12.5-12.75 GHz band in Regions 1 and 3. Therefore, in the 12.5-12.75 GHz band, these PFD limits from Regions 1 and 3 are considered applicable to EUTELSAT 133WA in Region 2.

The maximum PFD levels for EUTELSAT 133WA transmissions from the S-band telemetry beam (TTL/TTR) were calculated in the 2200-2300 MHz band and from the S2 Beam were calculated for the 12.5-12.75 GHz band. The results are provided in Schedule S and show that the downlink PFD levels of the EUTELSAT 133WA carriers do not exceed the limits specified in ITU Radio Regulations.

The following Tables provide updated PFD analyses for the Fixed and S1 downlink beams filed in the Original Petition. The updated PFD analysis for the Fixed Beam reflects the new pointing location for that downlink beam. The updated PFD analysis for the S1 Beam provides a "worst case" PFD analysis based upon the possibility of steering this downlink beam to different locations within the satellite footprint. These "worst case" PFD values were computed assuming maximum transmit EIRP density at every point on the Earth's surface down to elevation angles of 29° for the S1 Beam. The PFD values shown in Table 3 are applicable to beams: F1H5, F1H6, F1H7, F1V5, F1V6 and F1V7. The PFD values shown in Table 4 are applicable to beams: S1H7 and S1V7.

As can be seen, the FCC and ITU PFD limits will be met under any possible beam pointing scenario.

Table 3 Downlink Fixed Beam - Maximum PFD

Angle of Arrival	Applicable PFD Limit for Angle of Arrival	Worst Case PFD Level at Angle of Arrival	PFD Margin
	(dBW/m²/4kHz)	(dBW/m2/4kHz)	(dB)
0°	-150	-168.3	18.3
5°	-150	-168.2	18.2
10°	-147.5	-168.1	20.6
15°	-145	-168	23
20°	-142.5	-167.9	25.4
25°	-140	-162.8	22.8
Peak	-140	-147.4	7.4

Table 4 Downlink Steerable Beam #1 (S1) - Maximum PFD

Angle of Arrival	Applicable PFD Limit for Angle of Arrival	Worst Case PFD Level at Angle of Arrival	PFD Margin
	(dBW/m²/4kHz)	(dBW/m2/4kHz)	(dB)
0°	-150	-150.5	0.5
5°	-150	-150.2	0.2
10°	-147.5	-149.9	2.4
15°	-145	-149.5	4.5
20°	-142.5	-148.9	6.4
25°	-140	-148.3	8.3
Peak	-140	-147.4	7.4

13. Link Budgets

Link analysis was conducted for representative carriers in the S2 Beam. For each of these links, it was assumed that the nearest co-frequency satellites to EUTELSAT 133WA were Ciel-2 operating co-frequency in the 12.5-12.7 GHz downlink band at 128.85° W.L., AMC-4 operating co-frequency in the 14.0-14.25 GHz uplink band at 134.9° W.L. and AMC-1 operating co-frequency in the 14.0-14.25 GHz uplink band at 130.9° W.L..

The following assumptions were used in the link budget analysis:

- The link budgets are for clear sky operation.
- The clear sky link margins were chosen to provide sufficient link availability for the service(s).
- All transmitting and receiving earth stations have a cross-polarization isolation value of at least 27 dB within their main beam lobe.

The results of the analysis are shown in Exhibit 1 for the situation in which the Ciel-2, AMC-4 and AMC-1 links are operating at the power levels described below:

- AMC-4 and AMC-1 uplinks transmitting at -50 dBW/Hz at the antenna input; and
- Ciel-2 downlinks transmitting at -14.2 dBW/Hz towards CONUS beam peak and -19.9 dBW/Hz towards Canada beam peak.

14. Interference Analysis

This section, combined with the information provided in the equivalent section of the Original Petition (including the less than two-degree spacing analysis), presents the information specified in Section 25.140(a) (as required by Section 25.114(d)(7)).

The downlink EIRP density of EUTELSAT 133WA transmissions in the conventional or extended Ku-bands will not exceed levels provided in Section 25.140(a)(3)(ii). Associated uplink transmissions will not exceed applicable EIRP density envelopes in Sections 25.218, 25.222(a)(1), 25.226(a)(1) or 25.227(a)(1), unless the non-routine uplink and/or downlink operation is coordinated with operators of authorized co-frequency space stations at assigned locations within six degrees of the satellite. The Original Petition demonstrated how EUTELSAT 133WA could operate without causing unacceptable interference into the AMC-1 satellite that is spaced slightly less than two degrees away.

While this filing modifies the pointing of some beams and introduces a new S2 beam operating in the conventional Ku-band uplink, none of the changes or additions affect the original showing for EUTELSAT 133WA. Both the relocated beams and the new S2 Beam will meet the same EIRP density limits described above in this paragraph. Furthermore, the associated earth station emissions will comply with the EIRP density envelopes described above along with the further restrictions described in the Original Petition and associated submissions.

Per Section 25.140(a)(3)(iv), operations in the 13.0–13.25 GHz and 11.2–11.45 GHz bands will take into account the applicable requirements of Appendix 30B of the ITU's Radio Regulations. There are no United States Appendix 30B ITU filings within 6 degrees of 133 W.L.; therefore, there are no compatibility issues with EUTELSAT 133WA operations under Appendix 30B with respect to United States ITU Appendix 30B filings.

15. Compatibility between EUTELSAT 133WA and Ciel-2

Frequency overlap between Ciel-2 and EUTELSAT 133WA satellites (located at 128.85° W.L. and 132.85° W.L. , respectively) occurs in the 12.5-12.7 GHz downlink band. In this band, Ciel-2 operates over Canada and CONUS while EUTELSAT 133WA operates the S2 Beam over the Hawaii/Pacific region. Service areas

of Ciel-2 Canada and CONUS beams (CAN4 and CAN7, respectively), where receiving earth stations can be deployed, are defined by the -10 dB contour relative to peak gain.

This study assesses the worst-case interference level produced from EUTELSAT 133WA downlink transmissions into Ciel-2 earth station receivers. It demonstrates that the satellites are compatible in the 12.5-12.7 GHz band due to geographic beam separation and antenna discrimination.

Methodology

Table 5 below provides a summary of characteristics considered for both systems in the 12.5-12.7 GHz band, based on information contained in respective FCC applications. *See* File No. SES-MFS-20080926-01242 for Ciel-2.

Table 5 Ciel-2 and EUTELSAT 133WA Beam Details

	Ciel-2 – CONUS	Ciel-2 - Canada	EUTELSAT 133WA
Orbital location and tolerance	128.85°W +/- 0.05°	128.85°W +/- 0.05°	132.85°W +/- 0.1°
Peak EIRP density (dBW/Hz)	-14.2[2]	-19.9[3]	-23

Ciel-2 operates in circular left and right polarizations while EUTELSAT 133WA operates in linear horizontal and vertical polarizations. No polarization discrimination has been considered in the analysis, however, to ensure the worst case is covered.

Simulations

Simulations are based on the computation of single-entry C/I ratio from one satellite into earth stations associated with the other satellite. The earth stations are considered at the edge of the satellite service area. The service area of Ciel-2 is considered to be the -10 dB contour of CAN4 and CAN7 beams.

Since the S2 Beam of EUTELSAT 133WA is steerable, it can always be pointed with a sufficient isolation with respect to the Ciel-2 satellite's CAN4 and CAN7 beams. Specifically, Eutelsat proposes to point the S2 Beam so that the beam's -20 dB contour will always be outside of the -10 dB contour of CAN7 beam, and that the S2 Beam's -22dB contour will always be outside of the -10 dB contour of the CAN4 beam (accounting for beam and antenna size differences).

[2] Determination of the peak EIRP for Ciel-2 (CONUS beam) has been derived from link budgets presented for the CONUS beam, where EIRP towards Miami being 57.9 dBW/24 MHz, noting Miami is 1.7 dB below CAN7 beam peak. (Based upon analysis of the GXT files submitted for the Ciel-2 CONUS beam.)

[3] Therefore, Peak EIRP is assessed as 57.9 + 1.7 - 10*LOG(24) - 60=-14.2 dBW/Hz. Determination of the peak EIRP for Ciel-2 (Canada beam) has been estimated considering the peak EIRP of the Canada beam is 5.7 dB less than the peak EIRP of the CONUS beam.

Table 6, below, provides the computations of C/I ratio:

Table 6 Compatibility Analysis Between Ciel-2 and EUTELSAT 133WA

	EUTELSAT 133WA into Ciel-2 (CONUS)	EUTELSAT 133WA into Ciel-2 (Canada)
Interfering EIRP density at earth station location (dBW/Hz)	-43	-45
Interfered EIRP density at earth station location (dBW/Hz)	-24.2	-29.9
Topocentric angle (°)	4.2	4.2
Earth station size (m)	0.5	0.6[4]
Earth station antenna discrimination (dB)	19.1	22.5
C/I ratio (dB)	37.9	37.6
C/I target (dB)	20	20
C/I margin (dB)	17.9	17.6
I/N Clear Sky (dB)	-27.4	-29.3

This analysis demonstrates that achieved C/I ratio is well above required C/I. More importantly, in both cases the I/N is less than -20 dB. This translates to a level of interference that raises the noise floor by less than 0.2% resulting in a link degradation of no more than 0.01 dB. Therefore, EUTELSAT 133WA can operate simultaneously with Ciel-2 in the 12.5-12.7 GHz band without risk of interference into Ciel-2, considering the geographic isolation as detailed above.

Figure 1, below, depicts this geographic beam separation between the EUTELSAT 133WA S2 Beam and the Ciel-2 beams.

[4] Given the reduced EIRP density of the CAN4 beam, it is anticipated that the receive antenna diameter would be >60 cm. However, this cannot be confirmed because the publicly available link budgets for Ciel-2 do not include the Canada beam.

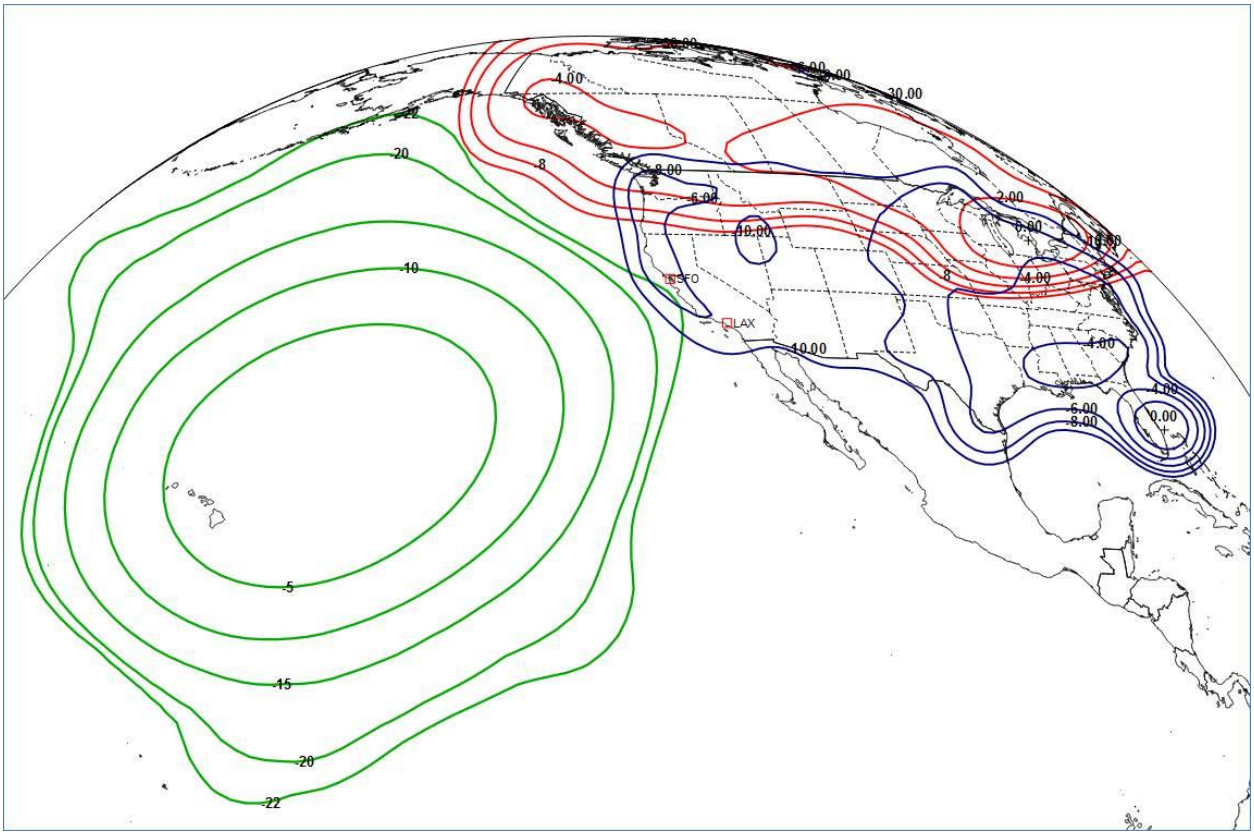

Figure 1 - EUTELSAT 133WA S2 Beam along with Ciel-2 coverages for CONUS and Canada beams (downlink EIRP in dBW relative)

As a result of geographic separation between the Ciel-2 CAN4 and CAN7 beams and the EUTELSAT 133WA S2 Beam, as well as earth station antenna discrimination, interference received by earth stations associated with the S2 Beam will be minimal. In addition, because the EUTELSAT 133WA S2 Beam will operating on a non-conforming (and thus unprotected) basis, Eutelsat will accept any and all interference received from Ciel-2 downlink transmissions.

Conclusion

This study demonstrates that sufficient geographic separation and antenna discrimination can be maintained to permit the EUTELSAT 133WA S2 Beam and Ciel-2 CAN4 and CAN7 beams to operate in the 12.5-12.7 GHz band without risk of harmful interference. In addition, coordination between the EUTELSAT 133WA and Ciel-2 satellites could provide even more flexibility for pointing the S2 Beam.

16. Compatibility between EUTELSAT 133WA and DIRECTV-7S/ EchoStar-14

After Ciel-2, the next closest DBS satellites are DIRECTV-7S at 119.05° W.L. and EchoStar-14 at 118.9° W.L. While both of these satellites are spaced greater than 9 degrees away from EUTELSAT 133WA,

they have overlapping coverage of Hawaii.[5] The following paragraphs demonstrate the worst-case C/I that could be introduced by the operation of the EUTELSAT 133WA S2 Beam over Hawaii.[6]

DIRECTV-7S and Echostar-14 operate in circular left and right polarizations while EUTELSAT 133WA operates in linear horizontal and vertical polarizations. No polarization discrimination has been considered in the analysis, however, to ensure the worst case is covered.

Since the S2 Beam is steerable, this analysis considers the peak EIRP density from the S2 Beam of -23 dBW/Hz. This would reflect the scenario where the S2 Beam is pointed directly at Hawaii. The DIRECTV-7S satellite provides a minimum EIRP of 44.8 dBW in a 24 MHz transponder over Hawaii. This translates to an EIRP density of -29.0 dBW/Hz. However, due to the lower EIRP density, the DIRECTV-7S satellite provides service to 90 cm receive antennas. The minimum topocentric angular spacing between EUTELSAT 133WA at 132.85° W.L. and DIRECTV-7S at 119.05° W.L. is 15.01°. The sidelobe isolation of a 90 cm BSS antenna is at least 40.3 dB per ITU-R BO-1213. The combined effects of relative power densities plus the receive antenna sidelobe isolation translates to a C/I of 34.3 dB.

The EchoStar-14 satellite provides a minimum EIRP of 50.2 dBW in a 24 MHz transponder over Hawaii. This translates to an EIRP density of -23.6 dBW/Hz. Given this higher EIRP density, EchoStar-14 satellite provides service to 45 cm diameter receive antennas. The minimum topocentric angular spacing between EUTELSAT 133WA at 132.85° W.L. and EchoStar-14 at 118.9° W.L. is 15.18°. The sidelobe isolation of a 45 cm BSS antenna is at least 34.4 dB per ITU-R BO-1213. The combined effects of relative power densities plus the receive antenna sidelobe isolation translates to a C/I of 33.8 dB.

Table 7, below, presents the computations of C/I ratio:

Table 7 Compatibility Analysis Between EUTELSAT 133WA and DIRECTV-7S / EchoStar-14

	EUTELSAT 133WA into DIRECTV-7S (Hawaii)	EUTELSAT 133WA into EchoStar-14 (Hawaii)
Interfering EIRP density at earth station location (dBW/Hz)	-23.0	-23.0
Interfered EIRP density at earth station location (dBW/Hz)	-29.0	-23.6
Topocentric angle (°)	15.01°	15.18°
Earth station size (m)	90 cm[7]	45 cm
Earth station antenna discrimination (dB)	40.3	34.4
C/I ratio (dB)	34.3	33.8
Victim Receive Antenna System Noise Temperature (°K)	105	105
I/N Clear Sky (dB)	-21.0	-21.1

[5] Both of these satellites provide a CONUS+ beam that covers Hawaii, and EchoStar-14 also forms a spot beam over Hawaii, but in that case there is no spectrum overlap in the 12.5-12.7 GHz band.

[6] This analysis was conducted using the technical information available for these systems on the FCC's International Bureau Filing System (IBFS) website and supplemented with typical operational values when not provided.

[7] It should be noted that the I/N analysis does not change for values of receive antenna aperture diameter from 45cm to greater than 1.2m.

As a result of significant orbital separation between EUTELSAT 133WA at the nominal 133° W.L. orbital location and DIRECTV-7S and EchoStar-14 at the nominal 119° W.L. orbital location, interference received by earth stations associated with S2 Beam of EUTELSAT 133WA will be minimal. In addition, because the EUTELSAT 133WA S2 Beam will operating on a non-conforming (and thus unprotected) basis, Eutelsat will accept any and all interference received from DIRECTV-7S and EchoStar-14.

Conclusion

This analysis demonstrates that, in both cases, the I/N introduced by EUTELSAT 133WA into DIRECTV-7S and EchoStar-14 is less than -20 dB. This translates to a level of interference that raises the noise floor by less than 1% resulting in a link degradation of no more than 0.04 dB. Therefore, EUTELSAT 133WA can operate simultaneously with DIRECTV-S and EchoStar-14 in the 12.5-12.7GHz band without risk of interference, considering the relative EIRP densities and angular separations as detailed above.

CERTIFICATION OF PERSON RESPONSIBLE FOR PREPARING ENGINEERING INFORMATION

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in this application, that I am familiar with Part 25 of the Commission's rules, that I have either prepared or reviewed the engineering information submitted in this application, and that it is complete and accurate to the best of my knowledge and belief.

/s/

_____

David C Morse, Ph.D.
Avaliant, LLC
Bellevue, WA USA
(425) 246-3080

September 8, 2018

EXHIBIT 1: SATELLITE LINK BUDGETS – Nominal Interference Conditions

eutelsat

	Forward link	*Return link*
SPACE SEGMENT		
Satellite	E133WA	E133WA
Orbital Position	-132.85	-132.85
Transponder	F2	F2
Bandwidth (MHz)	72	72
Uplink frequency (MHz)	14041.6700	14041.6700
Downlink frequency (MHz)	12541.6700	12541.6700
Uplink Coverage	ST2	ST2
Downlink Coverage	ST2	ST2
Uplink Polarization	X	X
Downlink Polarization	Y	Y
IPFD setting (dBW/m²)	-86	-89
IBO Multicarrier (dB)	8.4	8.4
OBO Multicarrier (dB)	3.7	3.7
CARRIER PARAMETERS		
Service category	DATA	DATA
Topology	OUTBOUND	INBOUND
Modem Manufacturer	Other	
Modem reference		
Technology	DVB-S2	
Pilots	ON	N/A
Frame	Normal	N/A
Modulation	4 PSK	4 PSK
FEC	1/2	1/2
Spreading Factor	1	1
Roll Off (%)	20	20
Spectral efficiency (bps)	0.97	1
Reed Solomon (n/k)	1	1
Symbol rate (Mbaud)	45	3
Usefull Bit rate (Mbps)	43.44	3
Overall Bit rate (Mbps)	43.44	3
E_b/N_0 (dB)	1.7	2.4
E_s/N_0 (dB)	1.55	2.4
BER		0.
CARRIER RESOURCES		
Transponder mode	ALC Single carrier	Linear
IBO carrier (dB)	0	23.4
OBO carrier (dB)	1	18.7
Bandwidth consumption (MHz)	54	3.6
Power consumption (MHz)	72	2.277
IPFD carrier (dBW/m²)	-92	-114.4
GROUND SEGMENT - UPLINK		
Earth Station Code	Hub	Remote
Country		
Location		
Longitude (°)	-157.97	202.48
Latitude (°)	21.36	21.2
Distance (km)	36950.72	36921.29
satellite G/T towards transmit station (dB/K)	6	2
Elevation angle (°)	52.16	52.65
Azimuth angle (°)	127.84	128.21
Antenna size (m)	11.1	0.55
Atmospheric losses (dB)	0.2	0.2
Uplink EIRP (dBW)	70.54	48.14
Post PA losses (dB)	4	0
Operating HPA Power (clear sky) (W)	8.24	15.32
HPA Rating (W)	52.	15.32
GROUND SEGMENT - DOWNLINK		
Earth Station	Remote	Hub
Country		
Location		
Longitude (°)	202.48	-157.97
Latitude (°)	21.2	21.36
Distance (km)	36921.29	36950.72
Antenna G/T towards satellite (dB/K)	12.62	37.09
Elevation angle (°)	52.65	52.16
Azimuth angle (°)	128.21	127.84
Antenna size (m)	0.55	11.1
Atmospheric Losses (dB)	0.3	0.3
Satellite EIRP towards receive station (dBW)	48	52
System temperature (K)	117	170.25
RESULTS		
Uplink Path Length (km)	36950.72	36921.29
Thermal Uplink C/N (dB)	21.67	7.03
Aggregated C/I Uplink (dB)	19.36	9.39
Uplink Propagation Losses (dB)	206.74	206.74
Downlink Path Length (km)	36921.29	36950.72
Thermal Downlink C/N (dB)	5.64	28.16
Aggregated C/I Downlink (dB)	21.85	18.46
Downlink Propagation Losses (dB)	205.75	205.76
C/N+I Overall (dB)	5.26	4.83
E_b/N_0 Overall (dB)	5.41	4.83
Clear Sky Link Margin (dB)	3.71	2.43
SUMMARY		
Bandwidth (MHz)	54	3.6
Power Equivalent Bandwidth (MHz)	72	2.277

Exhibit 2: Service and Coverage Areas

This exhibit illustrates the currently planned service areas of EUTELSAT 133WA uplink and downlink beams and their potential coverage areas.

Figures 1, 2 and 3 depict the updated service areas for the Fixed and S1 Beams. Figure 1 reflects the service area for Fixed uplink beams F1H5, F1H6, F1H7, F1V5, F1V6 and F1V7. Figure 2 reflects the service area for S1 uplink beams F1H1, F1H2, F1H3, F1V1, F1V2 and F1V3. Figure 3 reflects the service area for S1 uplink beams S1H3 and S1V3 and downlink beams S1H7 and S1V7.

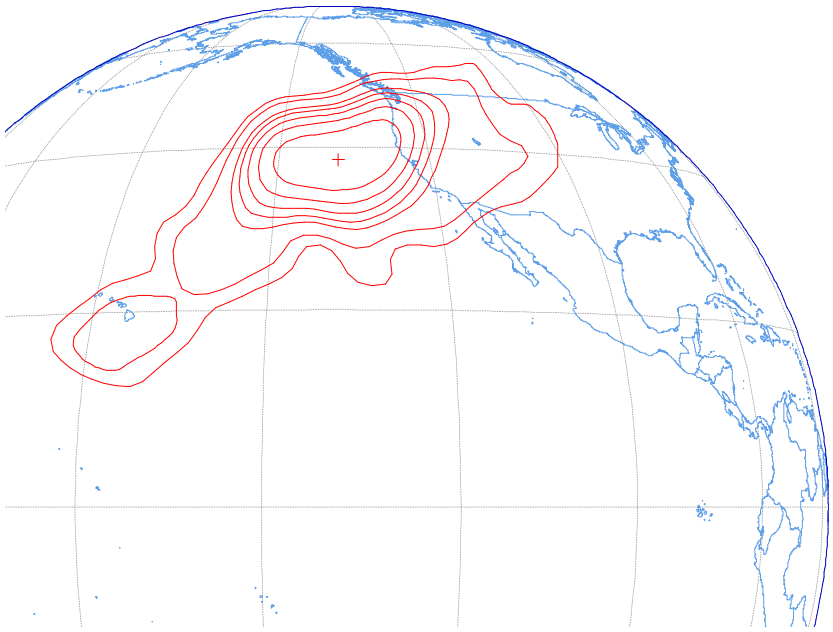

Figure 1 – Ku-band Fixed Beam Downlink Service Area from 132.85°W

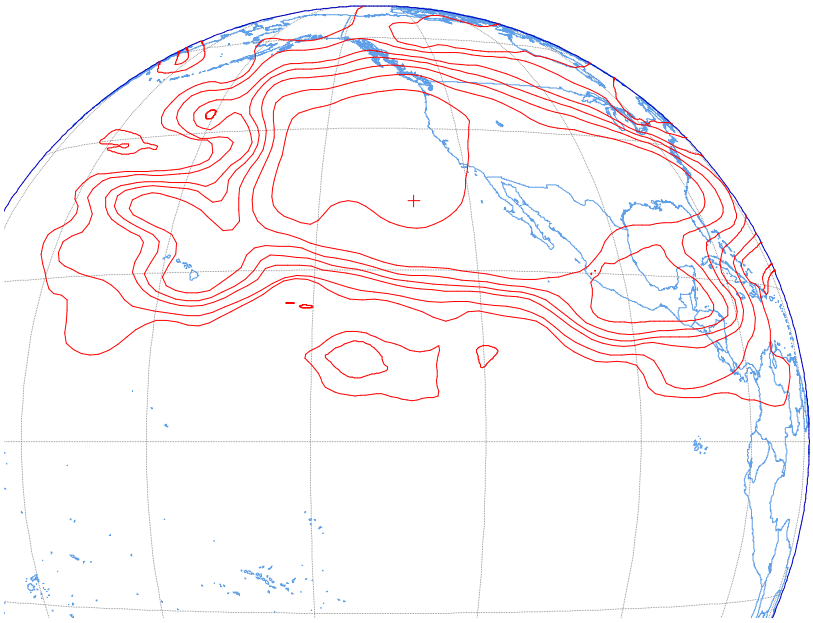

Figure 2 – Ku-band Fixed Beam Uplink Service Area from 132.85°W

Figure 3 – Ku-band S1 Beam Downlink & Uplink Service Area from 132.85°W

Since the S1 Beam can be steered anywhere within the satellite footprint, the maximum coverage area for the S1 uplink and downlink beams is the visible Earth from the 132.85˚ W.L. orbital position. Figure 4 depicts the coverage area for the S1 Beam's uplink and downlink beams. Because the S1 Beam includes Ku-band frequencies that can be directed throughout U.S. territory and are eligible for Permitted List operations, the FCC can be assured of spectrum compatibility of U.S. operations regardless of the orientation of the S1 Beam.

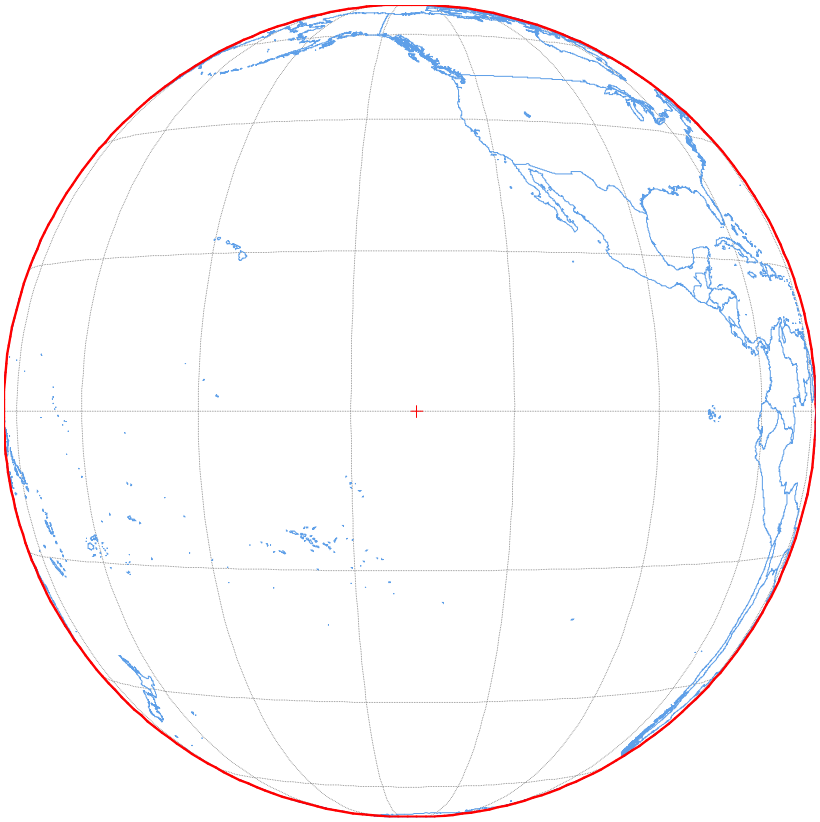

Figure 4 Ku-Band S1 Beam Coverage Area from 132.85°W

The S2 Beam uplink and downlink service area includes Hawaii and the surrounding Pacific Ocean. Figure 5 reflects the service area for S2 uplink beams S2H3 and S2V3, and for the downlink beams S2H8 and S2V8. This illustration reflects the currently planned pointing of S2 Beam.

Since the S2 Beam can be steered anywhere within the satellite footprint, subject to the limitation that the -20dB and -22 dB contours do not overlap with the -10 dB contours of the Ciel-2 CONUS and Canada beams, respectively. As a result, the coverage area for this beam is the satellite coverage footprint from the 132.85˚ W.L. orbital position with the exclusion of the area overlapping and near the Canada and CONUS coverage of Ciel-2. For example, the S2 Beam service area could be adjusted over Hawaii to cover different parts of the Pacific Ocean or could potential be repointed to the Aleutian Islands or elsewhere in response to customer needs, so long as there is no contour overlap as described herein. Figure 6 provides an illustration of the coverage area for the S2 Beam.

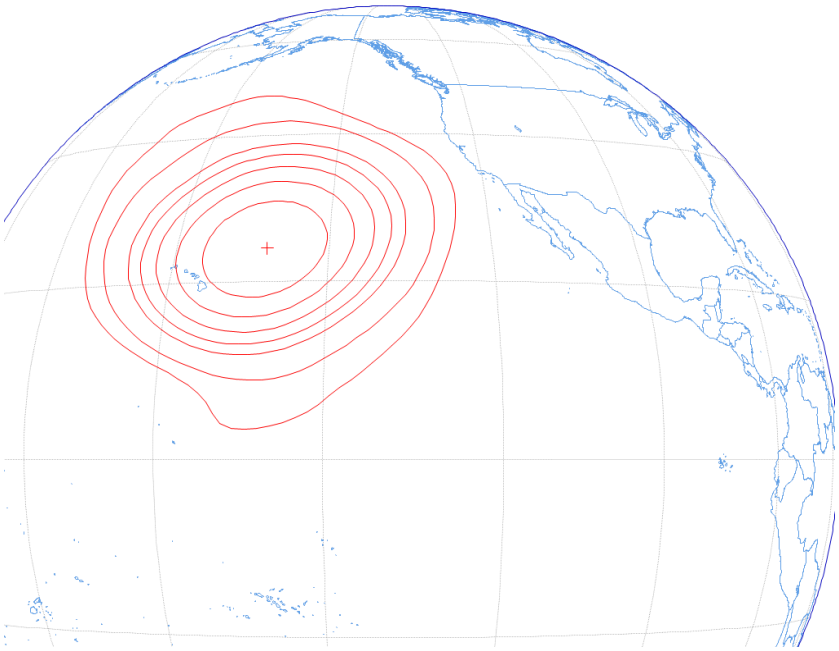

Figure 5 Ku-band S2 Downlink & Uplink Service Area from 132.85°W

Figure 6 Ku-Band S2 Coverage Area from 132.85°W