

WorldVu Development LLC
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April 4, 2022

Exhibit A: Narrative Statement

By this application, WorldVu Satellites Limited (“OneWeb”) seeks authority to operate twenty-five technically identical Viasat 3.7-meter antennas in Paumalu, Honolulu County, Hawaii (the “Paumalu Earth Station”). The Paumalu Earth Station will provide gateway connectivity to OneWeb’s low earth orbit (“LEO”), non-geostationary (“NGSO”), fixed-satellite service (“FSS”) system (“the OneWeb System”), which was granted U.S. market access in June 2017.¹ As of the date of this filing, OneWeb has successfully launched 428 satellites in connection with this grant of market access.²

The Paumalu Earth Station will enable OneWeb to expand its coverage and service in the United States. Additional gateway facilities are a critical part of OneWeb’s network infrastructure as it rolls out commercial service throughout the United States.³ Grant of this application will facilitate OneWeb’s ability to deliver ubiquitous, state-of-the-art broadband access to previously unserved and underserved population in the United States thereby serving the public interest.

I. Communications with Non-U.S.-Licensed Space Stations

OneWeb hereby incorporates the OneWeb U.S. Market Access Grant, by reference, into this application to demonstrate compliance with the requirements of Section 25.137 of the Commission’s rules for earth station applicants proposing to communicate with non-U.S.-licensed space stations.⁴

II. Spectrum Use and Sharing

Each antenna of the Paumalu Earth Station will be mounted on a separate fixed platform. Although the angle at which the antennas point will change with the tracking of OneWeb’s in-orbit satellites, each platform will remain stationary. The Paumalu Earth Station will communicate with the OneWeb System in the following frequency bands:

Downlink	Uplink
17.8-18.6 GHz	27.5-29.1 GHz
18.8-19.3 GHz	29.5-30.0 GHz

¹ See *WorldVu Satellites Limited, Petition for a Declaratory Ruling Granting Access to the U.S. Market for the OneWeb NGSO FSS System*, Order and Declaratory Ruling, 32 FCC Rcd 5366 (2017) (“*OneWeb U.S. Market Access Grant*”) (granting OneWeb market access for its NGSO FSS satellite constellation).

² *OneWeb Confirms Successful Launch of 34 Satellites, Delivering Ongoing Momentum at the Start of 2022*, ONEWEB (Feb. 10, 2022) <https://oneweb.net/resources/oneweb-confirms-successful-launch-34-satellites-delivering-ongoing-momentum-start-2022>.

³ To date, OneWeb has been granted four gateway earth station licenses in the United States. See *Satellite Communications Services, Actions Taken*, Public Notice, Report No. SES-02408 at 2-3 (rel. Oct. 13, 2021). See *Satellite Communications Services, Actions Taken*, Public Notice, Report No. SES-02296 at 4-5 (rel. Aug. 26, 2020); *Satellite Communications Services, Actions Taken*, Public Notice, Report No. SES-02217 at 3-4 (rel. Nov. 13, 2019).

⁴ See 47 C.F.R. § 25.137.

As illustrated below, the Paumalu Earth Station will operate in a manner consistent with the Commission's rules.

A. Uplink

1. 27.5-29.1 GHz

27.5-28.35 GHz. The Upper Microwave Flexible Use Service ("UMFUS") has a primary designation in the 27.5-28.35 GHz band in the Commission's Ka-band Plan, with a secondary designation for FSS.⁵ FSS earth stations are permitted to operate in the 27.5-28.35 GHz band and are not required to provide interference protection to future UMFUS operators if certain conditions are met.⁶ The Commission also clarified in the NGSO Order that "NGSO FSS systems must operate on an unprotected, non-interference basis with respect to GSO FSS networks" in the 27.5-28.35 GHz band.⁷

Section 25.136(a)(4) of the Commission's rules allows earth station licensees in the 27.5-28.35 GHz band to operate in accordance with the terms of their authorization without providing additional interference protection to UMFUS stations when four conditions are met.⁸ Appendix 1 of this document contains an analysis demonstrating compliance with those conditions, alleviating the need to provide additional interference protection to UMFUS operations in the 27.5-28.35 GHz band.

28.35-28.6 GHz. FSS is primary in the 28.35-28.6 GHz band, and the Ka-band Plan designated NGSO FSS as secondary to GSO FSS in this band.⁹

28.6-29.1 GHz. NGSO FSS is primary in the 28.6-29.1 GHz band pursuant to the U.S. Table of Frequency Allocations and the Ka-band Plan.¹⁰

⁵ *Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters*, Report and Order and Further Notice of Proposed Rulemaking, 32 FCC Rcd 7809 (2017) ("NGSO Order"); *NGSO Order*, 32 Rcd at 7850, App. B ("Ka-band Plan"); see also 47 C.F.R. § 25.136(a) ("FSS is secondary to the Upper Microwave Flexible Use Service in the 27.5-28.35 GHz band.").

⁶ See 47 C.F.R. § 25.136(a); see also *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014, 8036 ¶ 54 (2016).

⁷ *NGSO Order*, 32 FCC Rcd at 7817, ¶ 23.

⁸ See 47 C.F.R. § 25.136(a)(4); see also *Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, Second Report and Order, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, and Memorandum Opinion and Order, 32 FCC Rcd 10988, 11080, Appendix A (2017) ("*Second Spectrum Frontiers Order*") (adopting changes to this rule section).

⁹ See *Ka-band Plan*.

¹⁰ 47 C.F.R. § 2.106, NG165; see also *Ka-band Plan*. Additionally, in the *OneWeb U.S. Market Access Grant*, the Commission authorized OneWeb's uplink operations in this band. *OneWeb U.S. Market Access Grant*, 32 FCC Rcd at 5366, ¶ 1.

Terrestrial Coordination. The Comsearch Report attached separately as Exhibit B to this application demonstrates that, from the location in Paumalu, in the 27.5-28.35 GHz band: (1) OneWeb can operate the Paumalu Earth Station without causing harmful interference to existing terrestrial deployments, and (2) OneWeb coordinated with existing licensees, as required by the Commission.

GSO Systems. OneWeb makes no claim of interference protection from U.S.-licensed GSO FSS systems in the 27.5-28.6 GHz band. The ITU developed uplink equivalent power flux density (“EPFD_{up}”) limits to protect co-frequency GSO FSS operations from unacceptable interference from NGSO FSS systems operating in the same frequencies. Specifically, in accordance with Article 22 of the ITU Radio Regulations, if the applicable EPFD_{up} limits are met, then the Commission will consider the NGSO FSS satellite system to have met its obligations of protecting GSO FSS networks from unacceptable interference.¹¹ OneWeb has demonstrated that it meets the applicable ITU EPFD_{up} limits in all frequency ranges where these limits apply and certifies that its operations will be compliant with Article 22 and Resolution 76 of the ITU’s rules.¹² Consequently, the transmissions from the Paumalu Earth Station will sufficiently protect GSO FSS systems.

2. 29.5-30.0 GHz

The 29.5-30.0 GHz band is allocated to the FSS on a co-primary basis with the Mobile Satellite Service (“MSS”), with NGSO FSS having a secondary designation to GSO FSS pursuant to the Ka-band Plan.¹³ OneWeb makes no claim of interference protection from U.S.-licensed GSO FSS systems in this band,¹⁴ and the transmissions from the Paumalu Earth Station will sufficiently protect GSO FSS systems because the OneWeb system meets the applicable ITU EPFD_{up} limits in all frequency ranges where these limits apply.¹⁵

B. Downlink

Federal Coordination. Space-to-Earth operations in the bands between 17.7-20.2 GHz must complete coordination with U.S. Federal systems in accordance with footnote US334 to the U.S. Table of Frequency Allocations, 47 C.F.R. § 2.106, prior to being used. Footnote US334 lists several locations where federal space and earth station operations are primary. OneWeb is in

¹¹ See 47 C.F.R. § 25.146.

¹² See *WorldVu Satellites Limited, Petition for a Declaratory Ruling Granting Access to the U.S. Market for the OneWeb NGSO FSS System*, IBFS File No. SAT-LOI-20160428-00041, Technical Narrative (“*Market Access Application Technical Narrative*”) at 33-34; A2-9 – A2-12

¹³ 47 C.F.R. § 2.106; see also Ka-Band Plan

¹⁴ See *OneWeb U.S. Market Access Grant*, 32 FCC Rcd at 5377, ¶ 23(j). Similarly, OneWeb will operate in this band without seeking protection or causing harmful interference to any cofrequency MSS operations.

¹⁵ *Market Access Application Technical Narrative* at 33-34; A2-1 – A2-6. OneWeb believes that the EPFD_{up} limits associated with the protection of GSO FSS networks would also adequately protect any GSO MSS network.

the process of completing this required coordination for the proposed operations of the Paumalu Earth Station.

1. 17.8-18.3 GHz

In the NGSO Order, the Commission allocated the 17.8-18.3 GHz band on a primary basis to the terrestrial fixed service (“FS”) and on a secondary basis for FSS, subject to international power flux-density (“PFD”) limits.¹⁶ OneWeb previously demonstrated that secondary use of this band for its downlink operations will not cause harmful interference to FS operations because the OneWeb System meets the ITU PFD limits.¹⁷ Consequently, the Commission authorized OneWeb’s space stations to transmit in this band despite being on a nonconforming basis at the time.¹⁸ Moreover, the Comsearch Interference Analysis Report attached as Exhibit B to this application indicates that there will be no restrictions on OneWeb’s operations due to interference considerations in this band.

2. 18.3-18.6 GHz

The 18.3-18.6 GHz band is allocated on a primary basis to the FSS, as the NGSO Order amended the Ka-band Plan to “allow NGSO FSS systems to operate on an unprotected, noninterference basis with respect to GSO FSS networks in the 18.3-18.6 GHz . . . band[], subject to international equivalent power flux-density (“EPFD”) limits.”¹⁹ The ITU developed downlink EPFD (“EPFD_{down}”) limits to protect GSO FSS networks from unacceptable interference from NGSO FSS systems operating in the same frequencies. As with EPFD_{up} limits, if the NGSO FSS system meets the applicable EPFD_{down} limits, then the Commission will consider the NGSO FSS satellite system to have met its obligations to protect GSO FSS networks from unacceptable interference. OneWeb provided calculations for transmissions in this band showing that the OneWeb system meets the applicable ITU EPFD_{down} limits in all frequency ranges where these limits apply.²⁰ The Commission authorized OneWeb’s NGSO FSS system to transmit in this band.²¹

3. 18.8-19.3 GHz

The 18.8-19.3 GHz band is allocated to the FSS on a primary basis, and the Commission recently preserved the primary designation for NGSO FSS systems in the Ka-band Plan.²² The Commission authorized the OneWeb System to transmit in this band.²³

¹⁶ *NGSO Order*, 32 FCC Rcd at 7812, ¶¶ 7-8.

¹⁷ *See Market Access Application Technical Narrative* at 23-26; *see also id.*

¹⁸ *See OneWeb U.S. Market Access Grant*, 32 FCC Rcd at 5373, ¶ 16, 23. At the time of this grant, the Commission had not adopted a secondary allocation for FSS.

¹⁹ *NGSO Order*, 32 FCC Rcd at 7813, ¶¶ 9-10 (citing Section III.D.1); *see* 47 C.F.R. § 25.146.

²⁰ *See Market Access Application Technical Narrative* at 33-34; A2-1 – A2-8.

²¹ *OneWeb U.S. Market Access Grant*, 32 FCC Rcd at 5366, ¶¶ 16, 23.

²² *NGSO Order*, 32 FCC Rcd at 7814, ¶ 14.

²³ *OneWeb U.S. Market Access Grant*, 32 FCC Rcd at 5366, ¶ 1.

III. Radiation Hazard Report

Appendix 2 provides an updated radiation hazard analysis for the Paumalu Earth Station.

IV. FAA Notification

FAA notification is not required as the Paumalu Earth Station will not exceed 6.1 meters above ground.

V. Conclusion

As demonstrated herein, grant of OneWeb's Paumalu Earth Station application is in the public interest and meets the requirements of the Commission's rules.

Respectfully submitted,

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Appendix 1: 47 CFR § 25.136(a)(4) – UMFUS Compliance

The Commission’s rules define four elements that, if met, permit an earth station licensee to operate in accordance with the terms of its authorization without providing additional interference protection to Upper Microwave Flexible Use Service (“UMFUS”) stations in the 27.5-28.35 GHz band.²⁴ Based on the following analysis and waiver request contained in the sections below, the OneWeb Paumalu Earth Station located in Honolulu County, Hawaii complies with these criteria. Therefore, the Commission should authorize the Paumalu Earth Station without requiring additional protection for future UMFUS licensees in Honolulu, Hawaii.

1. § 25.136(a)(4)(i)

Under Section 25.136(a)(4)(i) of the Commission’s rules, no more than three FSS earth stations are permitted to be located within the same county.²⁵ The rule states that “multiple earth stations that are collocated with or at a location contiguous to each other shall be considered as one earth station,” and will therefore not count against the three FSS earth station limit.²⁶ In a Public Notice released in 2020, the Commission provided guidance on what it means to be “collocated” with another earth station and not be counted against the limit.²⁷ The Siting Guidance provides that the aggregate power flux density (“PFD”) contour must be “entirely contained within the contour or protection zone of the existing earth station.” When a proposed earth station will be collocated with a grandfathered earth station, “if the aggregate PFD contour or protection zone contains areas outside the contour or protection zone of the grandfathered earth station, the new earth station will be counted against the limit on the total number of earth stations for that licensing area.”²⁸

To the extent necessary, OneWeb requests a waiver of the collocation provision of the Siting Guidance as it is unduly restrictive and contradictory to the definition of collocation in the Commission’s rules.²⁹ Under the Commission’s existing rule, “multiple earth stations that are collocated with or at a location contiguous to each other *shall be considered* as one earth

²⁴ See 47 C.F.R. § 25.136(a)(4).

²⁵ See 47 C.F.R. § 25.136(a)(4)(i).

²⁶ *Id.*

²⁷ See *International Bureau Issues Guidance on Siting Methodologies for Earth Stations Seeking To Operate in the 24.75-25.25 GHz, 27.5–28.35 GHz, 37.5–40 GHz, 47.2-48.2 GHz, and 50.4-51.4 GHz Frequency Bands to Demonstrate Compliance with Section 25.136*, Public Notice, 35 FCC Rcd 6347 (2020) (“Siting Guidance”).

²⁸ *Id.*

²⁹ See 47 C.F.R. § 1.3; see, e.g., *PanAmSat Licensee Corp.*, 17 FCC Rcd 10483, 10492 (Sat. Div. 2002) (concluding that 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.”).

station.”³⁰ If the additional requirement from the Siting Guidance that the aggregate PFD contour from a new earth station must be contained within the contour or protection zone of the existing earth station were to be utilized, the addition of any collocated earth station would result in an aggregate PFD contour larger than that of the existing earth station (absent a change in the existing earth station’s technical parameters) and thus would be counted as a new FSS earth station against the three station per county limit. Accordingly, the Siting Guidance directly contradicts the established rule. Furthermore, the Siting Guidance is contrary to the public interest as it undermines the intent of 25.136(a)(4)(i), to encourage earth station collocation by exempting collocated antennas from the numerical limit.³¹

The Satellite Industry Association (“SIA”) filed a timely Petition for Reconsideration on this same issue, in which it correctly asserts that the Siting Guidance discussed in the Public Notice directly conflicts with the letter of Section 25.136(a)(4)(i) of the Commission’s rules.³² As SIA points out, the Siting Guidance counteracts this objective by “eliminating the incentive to collocate” and constrains “satellite operators’ ability to robustly use frequency bands shared between FSS and UMFUS,” resulting in “detrimental consequences to existing and future satellite systems.”³³ The SIA petition remains pending before the Commission.

If the Commission were to apply the Siting Guidance in the case of the Paumalu Earth Station, it would provide a prime example of the contradictory outcomes that would result based on the plain text reading of the existing rule and what the Siting Guidance suggests collocation means. Accordingly, the Commission should apply a plain language reading of Section 25.136(a)(4)(1) of its rules that “multiple earth stations that are collocated with or at a location contiguous to each other shall be considered as one earth station,” and, to the extent necessary, waive the portion of the Siting Guidance addressing collocation for good cause.

For the purposes of this application, OneWeb has followed a textual reading of Section 25.136(a)(4)(i), as explained above. This application assumes that in Honolulu County there are three FSS earth stations either licensed or with an application pending in the 27.5-28.35 GHz band, the maximum number of FSS earth stations permitted under the rule.³⁴ O3b Limited’s (“O3b”) earth stations collocated at 58-350 Kamehameha Highway count as the first earth station operating in the UMFUS band.³⁵ Licensees Viasat, Inc. (“Viasat”) and Hawaii Pacific Teleport

³⁰ See 47 C.F.R. § 25.136(a)(4)(i) (*emphasis added*).

³¹ See *Use of Spectrum Bands Above 24 GHz for Mobile Radio Services, Second Report and Order, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, and Memorandum Opinion and Order*, 32 FCC Rcd 11034 (2017) (“[F]or purposes of complying with the limit on the absolute number of earth station locations within an UMFUS license area, each location can accommodate multiple earth stations that are either collocated with each other or at locations contiguous to each other.”).

³² See *Petition for Reconsideration of the Satellite Industry Association*, IB Docket No. 17-172 (filed July 16, 2020) (“SIA Petition for Reconsideration”).

³³ See *id.* at 7-8.

³⁴ 47 C.F.R. § 25.136(a)(4)(i).

³⁵ See *O3b Limited Hawaii Earth Stations*, Call Signs E202133, E140107, E100088.

LLLP (“Hawaii Pacific”) are both licensed for separate earth stations, but are collocated at 91-340 Farrington Highway and count as the second earth station.³⁶ Lastly, Kuiper Systems LLC (“Kuiper”) has an application pending for an earth station in Honolulu county,³⁷ which would count as the third earth station, reaching the limit for earth stations in this county operating in the 27.5-28.35 GHz band.

The Paumalu Earth Station will be collocated with O3b’s earth stations and would not separately count toward the FSS earth station limit prescribed by Section 25.136(a)(4)(i). Accordingly, in granting a license to the Paumalu Earth Station, there would still be no more than three FSS earth stations operating in Honolulu County in the 27.5-28.35 GHz band.

2. § 25.136(a)(4)(ii)

Section 25.136(a)(4)(ii) prescribes that “the area in which the earth station generates a PFD, at 10 meters above ground level, of greater than or equal to -77.6 dBm/m²/MHz, together with the similar area of any other earth station authorized pursuant to paragraph (a) of this section, does not cover, in the aggregate, more than the amount of population of the UMFUS license area within which the earth station is located.”³⁸ O3b’s PFD contour analysis shows that it covers a population of 75 people.³⁹ Hawaii Pacific shows that its PFD contour analysis covers 0 people.⁴⁰ Viasat’s application was submitted prior to July 2016 and did not have to provide any population coverage analysis, but Kuiper computed the Viasat population coverage to be 150 people.⁴¹ Furthermore, Kuiper’s own population coverage analysis is 0 people,⁴² totaling 225 people affected by the PFD contour of all four existing (or pending) licensees in Honolulu County, Hawaii.

The PFD contour analysis in this application is based solely on the Paumalu Earth Station’s RF parameters, which demonstrates compliance with the Commission rules.⁴³

³⁶ See *Viasat, Inc. Hawaii Earth Station*, Call Sign E110046; *Hawaii Pacific Teleport LLLP Kapolei Earth Station*, Call Sign E150010.

³⁷ See *Kuiper Systems LLC, Application for Earth Station*, IBFS File No. SES-LIC-20210730-01290, Call Sign E210299 (“*Kuiper Application*”).

³⁸ 47 C.F.R. § 25.136(a)(4)(ii).

³⁹ See *O3b Limited Hawaii Earth Station Application, Letter to the Commission Updating 25.136 Showing at 5*, IBFS File No. SES-MOD-20190207-00084 (Jun. 20, 2019).

⁴⁰ See *Hawaii Pacific Teleport LLLP, Compliance with FCC §25.136*, IBFS File No. SES-MFS-20170721-00787.

⁴¹ See *Kuiper Application, Narrative & Exhibits* at 6.

⁴² *Id.*

⁴³ 47 C.F.R. §§ 25.136(a)(4)(ii) and (iii). OneWeb’s PFD compliance is supported by the Comsearch Report, Exhibit B, for which coordination is required with terrestrial users and stations in the 28 GHz band under 47 CFR § 25.203(c) and 47 CFR § 25.136 (a)(4). The Comsearch Report coordinates to a distance of 100 km. By contrast, the maximum distance computed for the 25.136(a)(4)(ii) PFD contour is 10 km. Therefore, given the breadth of the Comsearch coordination report, there is no need to redo the Comsearch coordination even if the size of the 25.136 contour increases due to aggregation between the O3b and OneWeb earth stations.

However, in the case of OneWeb's co-location with the existing O3b Earth Stations, OneWeb obtained the necessary technical parameters and PFD contour results of the collocated existing earth stations and is currently performing an aggregate PFD contour analysis for all the earth stations located in Paumalu, Hawaii in accordance with the Siting Guidance. OneWeb will supplement its application with an aggregate PFD contour and associated analysis pursuant to Sections 25.136(a)(4)(ii) and 25.136(a)(4)(iii), taking into account the collocation with the O3b Earth Stations, once this analysis is complete.

The total population of Honolulu County was used to determine the associated population coverage limit for Section 25.136(a)(4)(ii). According to the 2020 data from the U.S Census Bureau, the Honolulu County population is 1,016,508.⁴⁴ Section 25.136(a)(4)(ii) provides that, in a UMFUS license area with a population greater than 450,000 people, no more than 0.1 percent of the population may be within an earth station's PFD contour that is equal to or exceeds -77.6 dBm/m²/MHz to avoid having to provide interference protection to future UMFUS operators. Applying the associated population limit for Section 25.136(a)(4)(ii) of 0.1 percent to the Honolulu County population, the result is 1,016 persons.

As demonstrated below, the Paumalu Earth Station's PFD contour together with the population covered by the other earth stations in Honolulu County contains fewer than 1,016 persons. Using the ITU RR Appendix 7 Time-Variant Gain ("TVG") method, each of the 25 antennas of the Paumalu Earth Station would track a different OneWeb satellite above a minimum elevation angle of 5°. ⁴⁵ A composite, 25-antenna PFD contour was developed via proprietary software.⁴⁶ The proprietary software assumed the UMFUS reference antenna height of 10 meters above ground with a maximum threshold power of -158 dBW/MHz as required by 25.136(a)(4).⁴⁷ The UMFUS reference antenna is moved in small steps with an azimuth of +/- 180° around the Paumalu Earth Station location to measure the value of the received power at each location step.

The software assumed each of the 25 antennas would track the highest elevation satellite visible down to a minimum elevation angle of 5° while maintaining a GSO arc avoidance of 6°. This composite assessed the cumulative distribution function (CDF or joint probability) of potential interference representing the EIRP towards the horizon and the propagation statistics by

⁴⁴ *Honolulu County Hawaii Total Population*, United States Census Bureau (2020), <https://data.census.gov/cedsci/table?q=Honolulu%20County,%20Hawaii&tid=DECENNIALPL2020.P1>.

⁴⁵ In this analysis, the population data for each census tract within the Paumalu Earth Station PFD contour comes from the US Census data dated 2020. The propagation model implements a 1-arc second resolution SRTM Digital Terrain Elevation Data profile based on the ITU-R Recommendation P.452-15.

⁴⁶ The proprietary software result for other Earth stations application have been compared with the Visualyse PRO software to ensure consistency. See SES-LIC-20180604-01082.

⁴⁷ The -158 dBW/MHz is equivalent to the -77.6 dBm/m²/MHz value used in Section 25.136(a)(4), which was derived by converting the maximum PFD threshold to maximum input power before the antenna gain. Therefore, the antenna gain is 0 dBi. Then the PFD threshold converted to dBW/m²/MHz is -107.6 dBW/m²/MHz. If $G_{ant} = 0$ dBi, $I = PFD * A_e = -158$ dBW/MHz.

performing the convolution of the individual CDFs. No additional attenuation of the signal due to clutter was assumed.

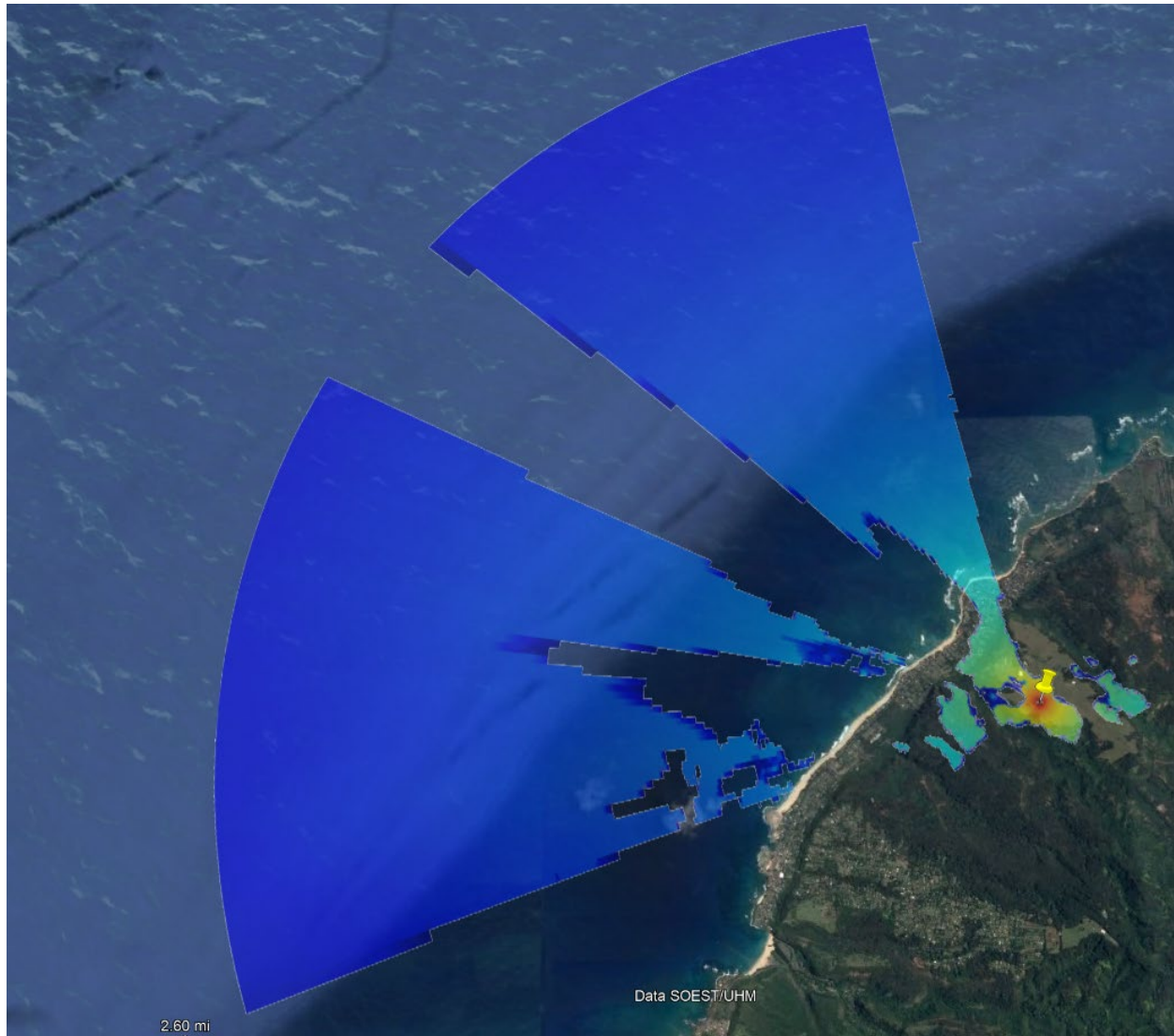
Table 1 contains the Paumalu Earth Station parameters.

Table 1: Paumalu Earth Station Parameters	
ES latitude (NAD 83)	21° 39' 59.9934 N"
ES longitude (NAD 83)	158° 1' 51.0018 W"
Ground Elevation (AMSL)	153.92 m
ES antenna size	3.7 m
ES input power density (clear sky)	-18.7 dBW/MHz
ES minimum elevation angle	5°
Earth station height to the midline	2.62 m
Number of active antennas at site	25
Simulation Frequency	28 GHz
Maximum Gain	58 dBi
Maximum EIRP	39.34 dBW/MHz

It should be noted that each antenna or Satellite Access Point (“SAP”) operates with a maximum 63 dBW EIRP/250 MHz in clear sky. In the event of rain fade, the EIRP of any OneWeb SAP would only be increased by a maximum of 3 dB (to 66 dBW) if the rain attenuation on the uplink path to the satellite exceeds 6 dB. OneWeb notes that using the clear-sky EIRP is justified because such rain events would typically occur in the direction of one or few antenna link(s) to the satellite, but not necessarily for all 25 antennas at the site pointing in different azimuths and elevation angles. The proprietary software considers aggregate emissions from all 25 antennas at the site where each antenna transmits continuously while tracking one NGSO satellite. Therefore, it is unlikely that all antennas would be subject to this same 6 dB or greater attenuation due to rain. Furthermore, if there is a 6 dB fade due to rain directly on the Paumalu Earth Station, the attenuation would also apply to the path from the earth station to UMFUS target location, thereby reducing the overall PFD at any direction around the earth station by at least 3 dB.

As a result, the TVG method calculates the area where the PFD limit could be exceeded, assuming a PFD value that is not exceeded for 99% of the time. The resulting PFD contour can be exported as a .KMZ file for viewing with a GIS mapping software. Figure 1 shows the resulting PFD contour of the analysis in Google Maps below.

Figure 1. PFD Contour for Paumalu Earth Station in Honolulu



The Paumalu Earth Station's PFD contour is superimposed with U.S Census tracts 2021 Hawaii data to determine which census tracts overlap partially or wholly with the PFD contour and derive the population coverage within each census tract.⁴⁸ This approach shows that only three census tracts are covered partially by the Paumalu Earth Station PFD contour. The census tracts 101.1, 101.02, and 9900.01 have a total population of 5,306.⁴⁹ Figures 2 and 3 below show a view of the PFD contour as it relates to census tracts 101.01, 101.02, and 9900.01.

⁴⁸ 2021 TIGER/Line Shape Files: Census Tracts, United States Census Bureau (2021), <https://www.census.gov/cgi-bin/geo/shapefiles/index.php?year=2021&layergroup=Census+Tracts>.

⁴⁹ Honolulu County Hawaii Census Tracts, United States Census Bureau (2020), <https://data.census.gov/cedsci/table?q=Honolulu%20County,%20Hawaii&g=0500000US15003%241400000&tid=DECENNIALPL2020.P1>.

Figure 2. Paumalu Earth Station PFD Contour Superimposed with Honolulu Census Tracts

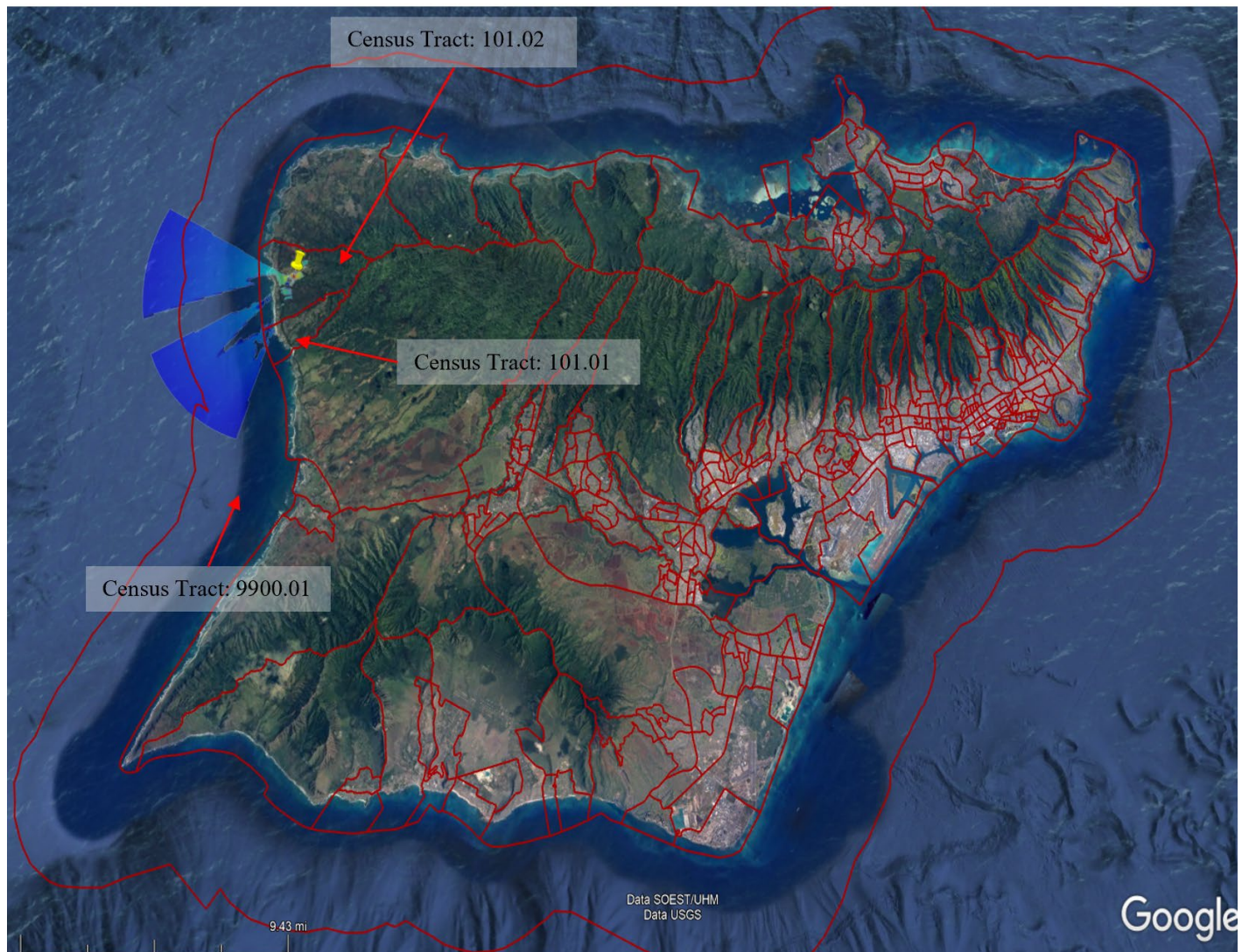


Figure 3. Wide View Showing PFD Contour Superimposed with Paumalu Census Tracts

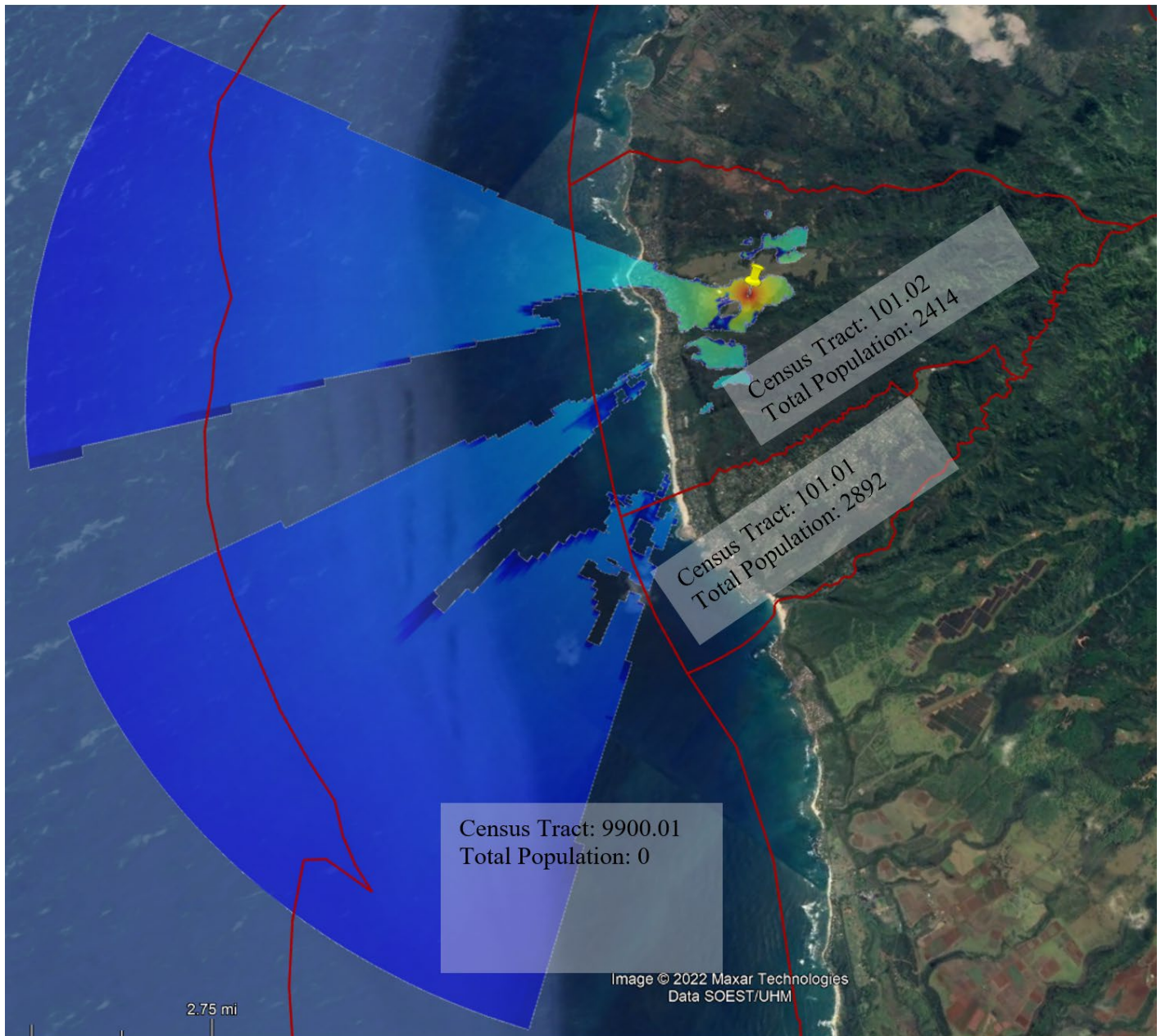


Table 2 provides the calculated population for each census tract impacted by the Paumalu Earth Station PFD contour using the actual area method:

Table 2: Population Coverage Statistics

Census Tract ID	Population	Proportion of Land Area of Census Tract Covered by the PFD contour (calculated)	Portion of Population Covered by the PFD contour (calculated)
101.01	2892	0 % ⁵⁰	0
101.02	2414	3.04%	73
9900.01	0	0%	0
Census Tract Covered Total Population: 73			

Therefore, 73 people are affected by OneWeb’s PFD contour. Recalling that Viasat’s contour covers 150 people, O3b’s contour covers 75 people, and Hawaii Pacific and Kuiper’s contours do not cover any of the population,⁵¹ the total population affected by OneWeb and the other existing licensees’ PFD contours is 298 people—well below the 0.1 percent of the Honolulu County population limit of 1,016 and confirms compliance with Section 25.136(a)(4)(ii).

OneWeb also reiterates that this analysis actually overestimates the population covered, as the analysis double counts the population covered by both the OneWeb and O3b contours.

⁵⁰ Even though OneWeb’s PFD contour affects the census tract, it only affects the part that is covered by water where the population would be 0. Therefore, the percent of the population affected by PFD contour in the census tract is 0.

⁵¹ See *supra* notes 39-41.

4. § 25.136(a)(4)(iv)

The Comsearch Report attached separately as Exhibit B to this application demonstrates that OneWeb completed coordination in compliance with the Section 25.136(a)(4)(iv) of the Commission's rules.

APPENDIX 2: RADIATION HAZARD REPORT

In accordance with OET Bulletin 65, this Radiation Hazard Report measured radiation exposure levels in seven zones for two cases—general population and occupational. The radiation levels calculated for each zone in Section II are derived from the calculations made in Section I. The results in Section III for OneWeb’s 3.7-meter Viasat antennas illustrate any radiation hazard that may exist for the general public and/or occupationally will be mitigated by limited access and various protocols to ensure safe exposure levels.

I. Defined Variables for OET Bulletin 65 Calculated Variables

Variables	Value	Unit	OET 65 Calculated Variables	Formula	Value	Unit
$D =$ <i>Aperture Diameter</i>	3.7	Meters	$\lambda =$ Wavelength	c/F	0.0104	Meters
$d =$ <i>Subreflector Diameter</i>	0.367	Meters	P _I = Total Antenna Input Power	P* η	128	Watts
$\eta =$ <i>Aperture Efficiency</i>	57.9%	Percentage	A = Area of reflector	$\pi(D/2)^2$	10.75210	Meters ²
<i>FCC Designation</i>	Ka	Band	a = area of sub-reflector	$\pi(d/2)^2$	0.10578	Meters ²
$F =$ <i>Frequency</i>	28750	MHz	G = Antenna Gain	$G = \frac{4\pi\eta A}{\lambda^2}$	719475.5659	Linear
$P =$ <i>Transmitter Power Watts</i>	128	Watts	Antenna Gain dB	10log ₁₀ (G)	58.57	dBi
$p =$ <i>Number of Transmitters</i>	1	#	R _{nf} = Near-Field Region	R _{nf} = D ² /4 λ	328.22	Meters
$R_{ua} =$ <i>Closest Point to Uncontrolled Area</i>	25	Meters	Transition Region	>R _{nf} <R _{ff}	328.22	>Meters
$R_{ua} =$ <i>Elevation angle at closest point</i>	5	Degrees			787.72	<Meters
					R _{ff} = Far-Field Region	R _{ff} = 0.6D ² / λ
					68.92	Meters AGL

II. Radiation Levels in Each Zone

Radiation Analysis Zone		Formula	Level	Value	Exposure Limits Met	
					General Public	Occupational
					<1mW/cm ²	<5mW/cm ²
1	Power Sub-reflector	$4P_I/a$	484.003	mW/cm ²	No	No
2	Antenna Surface	$4P_I/A$	4.762	mW/cm ²	No	Yes
3	Main Reflector Ground	P_I/A	1.19	mW/cm ²	No	Yes
4	$S_{nf} =$ Near-Field Power Density	$4\eta(P_I/A)$	2.757	mW/cm ²	No	Yes
5	Transition Max Power Density	$S_{nf} * R_{nf}/R_{nf}$	2.757	mW/cm ²	No	Yes
6	Far-Field Max Power Density	$P_I * G/4\pi R^2$	1.181	mW/cm ²	No	Yes
7	Off-axis Near Field	$S_{nf}-20dB$	0.02757	mW/cm ²	Yes	Yes

III. Results

General Public Analysis. OneWeb's 3.7-meter Viasat antennas will be located in an area clearly marked with Radiation Hazard signage with no access by the general public. Zones 1 through 5 in the above Table create no concern for the general public as they lie behind this signage where only authorized personnel may enter. Likewise, Zone 6—Far Field—also creates no concern for the general public because it develops 69 meters above ground level at a minimum elevation angle of five degrees where the general public cannot access. Accordingly, there is no risk of radiation exposure beyond the acceptable limits.

Occupational Analysis. Only around the Power Sub-reflector are any radiation levels exceeded. This measurement is taken at a point between the feed and the sub-reflector. Power to the transmitters will be turned off remotely whenever work needs to be performed in this Zone. Signage will mark the area for Radiation Hazard and access by qualified personnel only, facilitating awareness and safety. Consequently, there is no risk of radiation exposure beyond the acceptable limits.