GATEWAY LICENSE NARRATIVE

Kuiper Systems LLC, a wholly-owned subsidiary of Amazon.com Services LLC (collectively "Amazon"), seeks authority to operate a fixed gateway earth station ("gateway") in Casa Grande, AZ. This narrative demonstrates why authorizing this gateway would serve the public interest and explains how Amazon will operate consistent with the Commission's rules.

Amazon's Kuiper System will deliver satellite broadband communications services to tens of millions of unserved and underserved consumers and businesses in the United States and around the globe. According to the 2021 Broadband Deployment Report, 14.5 million Americans lack access to fixed terrestrial broadband with benchmark download and upload speeds of 25 Mbps and 3 Mbps, respectively.[1] Amazon's Kuiper System will help close this digital divide by offering broadband communications services, including connectivity to homes, schools, hospitals, government offices, businesses of all sizes, first responders, and disaster relief operations, to rural and hard-to-reach areas. The Kuiper System will also enable mobile network operators to expand wireless services to unserved and underserved mobile customers and provide high-throughput mobile broadband connectivity services for aircraft, maritime vessels, and land vehicles. This gateway will be another step toward providing these urgently needed services to the American public.

The proposed gateway will consist of six (6) technically identical antennas that will communicate with Amazon's non-geostationary orbit ("NGSO") fixed-satellite service ("FSS") and mobile-satellite service ("MSS") Kuiper System in the frequency bands 27.5-30.0 GHz (Earth-

[1] *See Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, Fourteenth Broadband Deployment Report, GN Docket No. 20-269, FCC 21-18 ¶ 2 (rel. Jan. 19, 2021).

to-space) and 17.8-18.6 GHz and 18.8-20.2 GHz (space-to-Earth). No more than four (4) antennas will transmit on the same channel at any one time.

I. PUBLIC INTEREST BENEFITS

In July 2020, Amazon received Commission authority to launch and operate its Kuiper System in the frequency bands 17.7-18.6 GHz,[2] 18.8-20.2 GHz, and 27.5-30.0 GHz.[3] As noted above, compelling public interest benefits justify expeditious authorization of this gateway. Amazon's customer-centric approach inspired the development of the Kuiper System and delivery of reliable, high-speed, low-latency broadband. The gateway will allow Amazon to deliver its broadband service to residential, mobility, enterprise, and government customers.

II. SPECTRUM USE AND SHARING

Amazon will adhere to all International Telecommunication Union ("ITU") and Commission requirements and pertinent future FCC rulemakings governing NGSO Ka-band gateways. When sharing spectrum, Amazon will operate consistent with its License[4] and the Commission's rules, as discussed below.

a. Kuiper System Gateway Transmit Frequencies

The gateway will transmit to Kuiper System satellites in the frequencies listed in Table 1 and follow relevant sharing requirements in the Commission's rules.

[2] Although Amazon requested access to the frequency band 17.7-17.8 GHz, it will only use this segment for space-to-Earth gateway operations outside the United States and its territories. *See Kuiper Systems, LLC*, Order and Authorization, 35 FCC Rcd 8324 ¶ 59(g) (2020) ("License").

[3] *See id.* ¶ 2.

[4] *See id.* ¶ 59.

Table 1: Kuiper System Gateway Transmit Frequencies

Transmit Frequencies (GHz)	Status[5]
27.5-28.35	NGSO FSS secondary to UMFUS and GSO FSS
28.35-28.6	NGSO FSS secondary to GSO FSS
28.6-29.1	NGSO FSS primary
29.1-29.5	NGSO MSS feeder link co-primary
29.5-30.0	NGSO FSS secondary to GSO FSS

i. 27.5-28.35 GHz (NGSO FSS secondary to UMFUS)

NGSO FSS may transmit on a secondary basis without providing interference protection to the Upper Microwave Flexible Use Service ("UMFUS") in the 27.5-28.35 GHz band.[6] Exhibit A, the UMFUS analysis, demonstrates how the gateway satisfies the section 25.136(a) protection criteria and, therefore, does not need to protect future UMFUS deployments.[7] Exhibit C, the Comsearch report, establishes that Amazon has coordinated with UMFUS licensees consistent with section 101.103(d).[8]

[5] *See generally* 47 C.F.R. § 2.106; *Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters*, Report and Order and Notice of Proposed Rulemaking, 32 FCC Rcd 7809 (2017) ("*NGSO FSS Order*"); *id*. at Appendix B ("Ka-band Plan").

[6] *See* 47 C.F.R. §§ 2.106, 25.136; *International Bureau Issues Guidance on Siting Methodologies for Earth Station 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).

[7] *See* 47 C.F.R. § 25.136(a); Exhibit A.

[8] *See* 47 C.F.R. § 101.103(d); Exhibit C.

ii. 27.5-28.6 GHz and 29.5-30.0 GHz (NGSO FSS secondary to GSO systems)

NGSO FSS may transmit on a secondary basis to geostationary orbit ("GSO") FSS in the 27.5-28.6 GHz and 29.5-30.0 GHz bands.[9] Amazon does not claim interference protection from GSO FSS in these bands and certifies it will comply with the applicable equivalent power flux-density ("EPFD") limits in ITU Radio Regulations Article 22 and Resolution 76 to ensure transmissions do not cause harmful interference.[10]

iii. 28.6-29.1 GHz (NGSO FSS primary)

NGSO FSS may transmit on a primary basis in the 28.6-29.1 GHz band.[11] Amazon's operations as NGSO FSS possess primary status in the band.[12]

iv. 29.1-29.5 GHz (NGSO MSS feeder link co-primary)

NGSO MSS feeder links may transmit on a co-primary basis with the Local Multipoint Distribution Service ("LMDS") in the 29.1-29.25 MHz band and FS in the 29.25-29.5 GHz band.[13] As described in the following sub-sections, the Commission has granted Amazon authority to

[9] *See* 47 C.F.R. § 2.106; Ka-band Plan.

[10] *See* 47 C.F.R. §§ 2.106, 25.115(f)(1), 25.146(a)(2); Ka-band Plan; ITU Radio Regulations Article 22 and Resolution 76 (WRC-15); *see also Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band Frequency Range*, 16 FCC Rcd 4096 ¶ 77 (2000) (concluding that compliance with EPFD limits "will adequately protect GSO FSS networks") ("*2000 NGSO FSS Order*").

[11] *See* 47 C.F.R. § 2.106; Ka-band Plan.

[12] *See* License ¶ 11; 47 C.F.R. § 25.261. In the 28.5-29.1 GHz band, Amazon will not cause harmful interference to, or claim protection from, grandfathered Fixed Service ("FS") stations as required by the Commission's rules. *See* 47 C.F.R. § 2.106 n.NG62.

[13] *See* 47 C.F.R. § 2.106; Ka-band Plan.

operate NGSO MSS feeder links in this band and, therefore, the gateway may operate on a primary basis.[14]

1. NGSO MSS feeder link

To share with other co-primary NGSO MSS feeder link systems, Amazon will coordinate use of the band with NGSO system operators not included in the March 2020 processing round before commencing service[15] and employ the section 25.261 spectrum-sharing framework with NGSO system operators in the March 2020 processing round while operating service.[16]

2. LMDS

To share with LMDS, Amazon will coordinate as required by the Commission's rules.[17]

3. FS

To share with FS, Amazon will not cause harmful interference to, or claim protection from, grandfathered FS stations as required by the Commission's rules.[18]

b. Kuiper System Gateway Receive Frequencies

The gateway will receive transmissions from the Kuiper System in the frequencies listed in Table 2 and follow relevant sharing requirements in the Commission's rules.[19]

[14] *See* License ¶¶ 24-25 and n.7.

[15] Before using this band, Amazon will coordinate with NGSO MSS feeder link systems using the same frequencies and polarizations as Amazon. *See* License ¶ 59(i).

[16] *See id.*

[17] *See* 47 C.F.R. § 101.103(d).

[18] *See* 47 C.F.R. § 2.106 n.NG62.

[19] Before operating in these bands, Amazon will complete coordination with U.S. Federal systems. *See id.* n.US334; License ¶ 59(m).

Table 2: Kuiper System Gateway Receive Frequencies

Frequencies (GHz)	Status[20]
17.8-18.3	NGSO FSS secondary to FS and GSO FSS
18.3-18.6	NGSO FSS secondary to GSO FSS
18.8-19.3	NGSO FSS primary
19.3-19.4 and 19.6-19.7	NGSO FSS secondary to FS, NGSO MSS FL, and GSO FSS
19.4-19.6	NGSO MSS feeder link co-primary
19.7-20.2	NGSO FSS secondary to GSO FSS

i. 17.8-18.3, 19.3-19.4, and 19.6-19.7 GHz (NGSO FSS secondary to FS)

NGSO FSS may receive on a secondary basis to FS in the 17.8-18.3, 19.3-19.4, and 19.6-19.7 GHz bands.[21] To share with FS, Amazon will meet the power flux-density limits in ITU Radio Regulations Article 21.[22] The Comsearch report confirms no additional limitations are necessary.[23]

[20] *See generally* 47 C.F.R. § 2.106; *NGSO FSS Order*; Ka-band Plan.

[21] *See* 47 C.F.R. § 2.106; Ka-band Plan.

[22] *See* License ¶¶ 13, 59(d)-(e).

[23] *See* Exhibit C.

ii. 17.8-18.6, 19.3-19.4, 19.6-19.7, and 19.7-20.2 GHz (NGSO FSS secondary to GSO FSS)

NGSO FSS may receive on an unprotected, non-interference basis with respect to GSO FSS in the 17.8-18.6 GHz, 19.3-19.4 GHz, 19.6-19.7 GHz, and 19.7-20.2 GHz bands.[24] To share with GSO FSS, Amazon will comply with the applicable EPFD limits in ITU Radio Regulations Article 22 and Resolution 76.[25]

iii. 18.8-19.3 GHz (NGSO FSS primary)

NGSO FSS may receive on a primary basis in the 18.8-19.3 GHz band.[26] Amazon's operations qualify as NGSO FSS and, therefore, possess primary status in the band.[27]

iv. 19.3-19.4 and 19.6-19.7 GHz (NGSO FSS secondary to NGSO MSS feeder link)

NGSO FSS may receive on a secondary basis to NGSO MSS feeder link systems in the 19.3-19.4 and 19.6-19.7 GHz bands.[28] To share with NGSO MSS feeder links, Amazon will coordinate use of the band with NGSO system operators not in the March 2020 processing round before commencing service[29] and employ the section 25.261 spectrum-sharing framework with NGSO system operators in the March 2020 processing round while operating service.[30]

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[24] *See* 47 C.F.R. § 2.106; Ka-band Plan.

[25] The Commission has found that EPFD demonstrations may permit NGSO FSS to share frequency bands with GSO FSS. *See* License ¶¶ 13, 14, 59(d)-(e); *NGSO FSS Order* n.84; *see also 2000 NGSO FSS Order* ¶ 77.

[26] *See* 47 C.F.R. § 2.106; Ka-band Plan.

[27] *See* License ¶ 11.

[28] *See* 47 C.F.R. § 2.106; Ka-band Plan.

[29] Before using this band, Amazon will coordinate with NGSO MSS feeder link systems using the same frequencies and polarizations as Amazon. *See* License ¶ 59(i).

[30] *See id.*

v. 19.4-19.6 GHz (NGSO MSS feeder link co-primary)

NGSO MSS feeder links may receive on a co-primary basis with FS in the 19.4-19.6 GHz band.[31] To share with co-primary MSS feeder link systems, Amazon will coordinate use of the band with operators not in the March 2020 processing round before commencing service[32] and employ the section 25.261 spectrum-sharing framework with operators in the March 2020 processing round while operating service.[33]

III. ANTENNA PATTERN

There are no Commission standards for NGSO Ka-band gateway antenna pattern performance. The available standards consider only GSO Ku-/Ka-band or NGSO Ku-band operations because the Commission has "not yet determined what off-axis gain envelopes might be appropriate for [Ka-band] gateways operating with NGSO FSS space stations, either to facilitate NGSO-to-NGSO or NGSO-to-GSO interference protection."[34] Amazon, nonetheless, will comply with the section 25.209(a)(1) mask for GSO Ka-band earth station antennas, as illustrated in Exhibit D.[35]

IV. RADIATION HAZARD ANALYSIS

Exhibit B, the Radiation Hazard Analysis, confirms that Amazon complies with relevant Commission standards and demonstrates there is no risk of radiation exposure beyond the

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[31] *See* 47 C.F.R. § 2.106; Ka-band Plan.

[32] Before using this band, Amazon will coordinate with NGSO MSS feeder link systems using the same frequencies and polarizations as Amazon. *See* License ¶ 59(i).

[33] *See id*.

[34] *Comprehensive Review of Licensing and Operating Rules for Satellite Services*, Report and Order, 30 FCC Rcd 14713 ¶ 213 (2015). *See also NGSO FSS Order* ¶¶ 54-55 and n.121 (declining to adopt NGSO gateway antenna performance standards). *See generally* 47 C.F.R. §§ 25.209, 25.132.

[35] *See* 47 C.F.R. § 25.209(a)(1); Exhibit D.

acceptable limits.[36] To further protect the general public, Amazon will site the gateway either behind a fence or on private commercial property with limited access. Trained technicians responsible for operating the gateway will turn off and secure the transmitters before performing any maintenance work.

V. FAA NOTIFICATION

For an antenna structure of 6.1 meters or less in height above ground level, the Commission requires no Federal Aviation Administration ("FAA") notification.[37] Amazon's antenna structure for the gateway measures 6.1 meters or less in height above ground level and requires no FAA notification.

VI. CONCLUSION

Amazon has satisfied the Commission's licensing standards for NGSO Ka-band gateways. As a result, timely action on this application will accelerate the deployment of the Kuiper System and its ability to expand broadband access for consumers, schools, hospitals, businesses and other organizations across the country.

[36] *See* FCC OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Exhibit B.

[37] *See* 47 C.F.R. §§ 17.2 (defining antenna structure as a structure that is constructed or used to transmit and/or receive radio energy or that supports antennas that transmit and/or receive radio energy and other appurtenances mounted thereon), 17.7(e), 25.115(j).

EXHIBIT A (SECTION 25.136 UMFUS PROTECTION ANALYSIS)

This exhibit demonstrates that the proposed gateway earth station ("gateway") satisfactorily protects 27.5-28.35 GHz Upper Microwave Flexible Use Service ("UMFUS") deployments in Pinal County, AZ ("County").

Section 25.136(a)(4) of the Commission's rules outlines how Fixed-Satellite Service ("FSS") operators may deploy gateways in the 27.5-28.35 GHz band without providing additional interference protection to co-frequency UMFUS licensees.[1] *First*, one U.S. county may not possess more than three co-frequency FSS gateways. *Second*, an FSS gateway generating a power flux-density ("PFD") greater than or equal to -77.6 dBm/m^2/MHz at 10 meters above ground level ("-77.6 dBm/m^2/MHz"), together with the similar area of any other gateway authorized under Section 25.136(a)(1)-(4), may not cover more than certain population amounts.[2] *Third*, the -77.6 dBm/m^2/MHz PFD contour may not contain any major event venue, urban mass transit route, passenger railroad, cruise ship port, or certain roads (Interstate, Other Freeways and Expressways, or Other Principal Arterial). *Fourth*, the FSS operator must coordinate with existing UMFUS licensees located within a PFD contour greater than or equal to -77.6 dBm/m^2/MHz.

Amazon complies with Section 25.136(a)(4) and the Guidance. No more than three FSS gateways will operate in the County hosting the proposed gateway. Amazon's -77.6 dBm/m^2/MHz PFD contour covers no more than 85 people of the County's total 375,770 people, which is less than the 450 limit for a county with 6,000-450,000 people. The PFD contour does not contain any major event venue, urban mass transit route, passenger railroad, cruise ship port, Interstate, Other Freeways and Expressways, or Other Principal Arterial. Amazon has also completed coordination with existing UMFUS licensees, as required.[3]

The Commission, therefore, should authorize this proposed gateway and not require Amazon to provide additional interference protection to UMFUS licensees in this County.

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[1] *See* 47 C.F.R. § 25.136(a)(4) ("Section 25.136"). The Commission has offered additional guidance on how to present Section 25.136 showings. *See generally 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 (IB 2020) ("Guidance").

[2] *See* Section 25.136 at Table 1 to Paragraph (A)(4)(ii) (permitting the PFD contour to cover 0.1 percent of the population in a county with more than 450,000 people; 450 people in a county with 6,000-450,000 people; and 7.5 percent of the population in a county with fewer than 6,000 people).

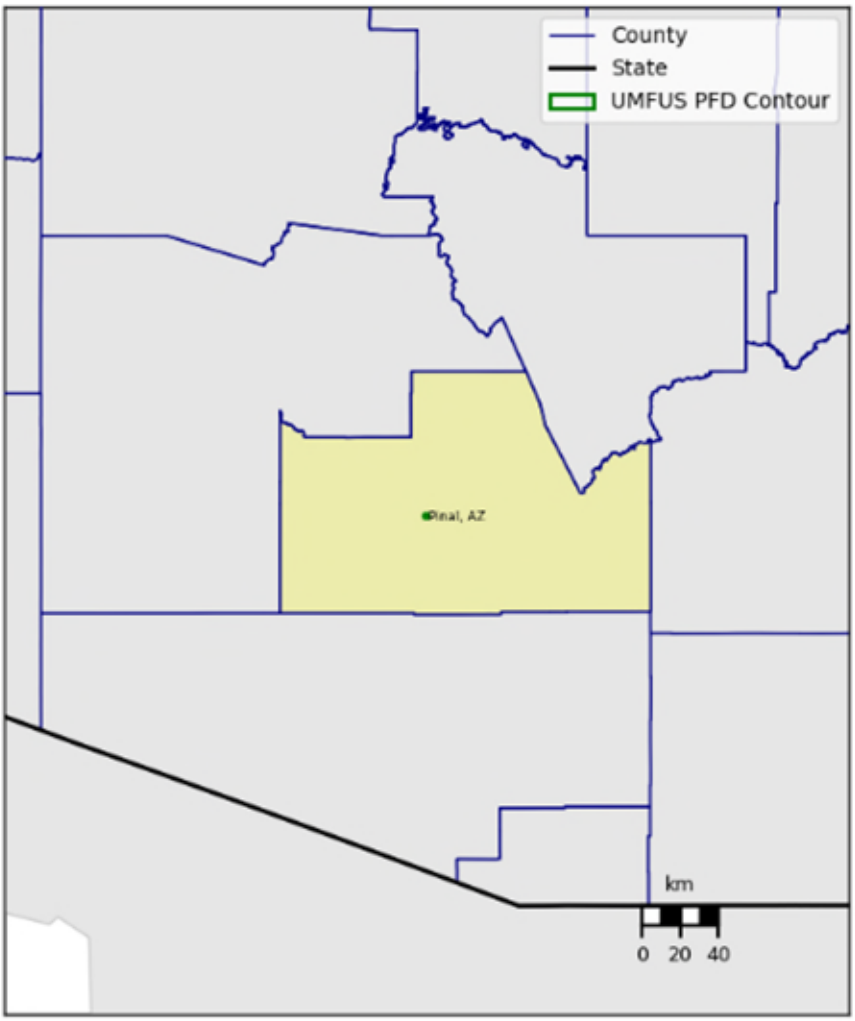
[3] *See* Exhibit C, Comsearch Coordination Report.

Section 25.136(a)(4)(i) (no more than three co-frequency FSS gateways in one county)

(i) There are no more than two other authorized earth stations operating in the 27.5-28.35 GHz band within the county where the proposed earth station is located that meet the criteria contained in either paragraph (a)(1), (2), (3), or (4) of this section. For purposes of this requirement, multiple earth stations that are collocated with or at a location contiguous to each other shall be considered as one earth station.

Figure 1 depicts the gateway's location in the County. As of the date of this submission, the Commission's International Bureau Filing System shows zero FSS licensees using the 27.5-28.35 GHz band in the County. This gateway, therefore, complies with Section 25.136(a)(4)(i).

Figure 1. Location of Amazon Gateway



PFD contour generation for 25.136(a)(4)(ii)–(iv)

To verify compliance, Amazon generated the gateway's -77.6 dBm/m^2/MHz PFD contour as shown in Figure 2. The gateway's maximum aggregate equivalent isotropic radiated power ("EIRP") from its four active antennas will be -16.2 dBW/MHz at the horizon in any azimuth direction. Amazon will also deploy this gateway with a standard shielding solution that will provide at least 15 dB of attenuation on the gateway transmissions.[4] The shielding solution will entirely surround the gateway. The effective EIRP at the horizon will be no greater than -31.2 dBW/MHz with the shielding attenuation included.

Field	**Value**	**Units**
County	Pinal County, AZ	
Coordinates	32.89N, 111.51W	
Simulation Frequency	27.5	GHz
Number of Active Antennas	4	
Worst-case Antenna Gain toward the Horizon	-0.5	dBi
Average Gain toward the Horizon	-10.0	dBi
RF Transmit Power	-17.0	dBW/MHz
Aggregate EIRP toward the Horizon (without Shielding)[5]	-16.2	dBW/MHz
Aggregate EIRP toward the Horizon (with Shielding)[6]	-31.2	dBW/MHz

Amazon generated the proposed gateway's -77.6 dBW/m^2/MHz PFD contour using proprietary satellite communications and geospatial analysis software and verified the results using Visualyze Pro. To assess radio propagation, Amazon used ITU-R Recommendation P.452 and National Aeronautics and Space Administration Shuttle Radar Topography (Version 2) digital topology data, which employs a 1-arc second resolution.[7] The antenna gain toward the horizon is derived from antenna manufacturer simulations and complies with the section 25.209(a)(1)[8] antenna gain

[4] *See* Guidance at 3 (computing PFD contours and protection zones at bullet 4).

[5] This figure is based on three of the four active antennas operating at average gain (-10 dBi) and one of the four active antennas operating at the worst case gain (-0.5 dBi). It is extremely unlikely that more than one active antenna will be in a worst-case position at the same time.

[6] This figure is the Aggregate EIRP toward the Horizon (without Shielding) minus an additional 15 dB of attenuation for shielding.

[7] *See* Guidance at 3 (computing PFD contours and protection zones at bullets 2 and 4).

[8] *See* 47 C.F.R. § 25.209(a)(1); *see also* Guidance at 3 (computing PFD contours and protection zones at bullet 3).

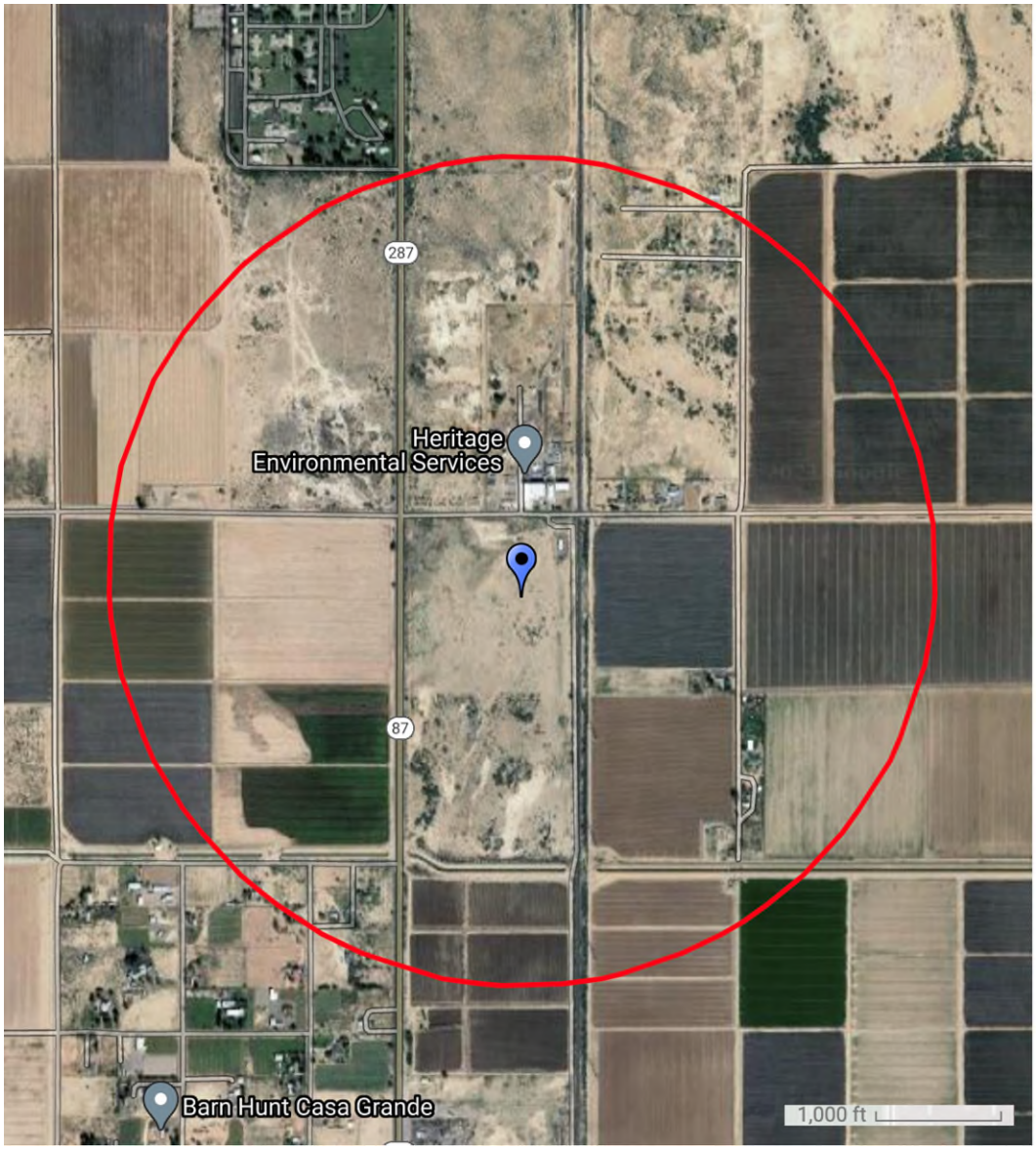
masks for all off-axis angles.[9] The PFD contour is generated using the worst case input power density rather than the input power density during clear sky conditions.[10]

Figure 2 on the following page shows Amazon's PFD contour in Google Earth and confirms the contour complies with the Guidance.

[9] *See* Guidance at 3 (computing PFD contours and protection zones at bullet 3).

[10] *See id.* (computing PFD contours and protection zones at bullet 5).

Figure 2. Gateway PFD Contour



Section 25.136(a)(4)(ii) (-77.6 dBm/m^2/MHz PFD contour covering only certain population totals)

(ii) 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/m^2/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 as noted in table 1 to this paragraph (a)(4)(ii).

TABLE 1 TO PARAGRAPH (a)(4)(ii)

Population within UMFUS license area	Maximum permitted aggregate population within −77.6 dBm/m^2/MHz PFD contour of earth stations
Greater than 450,000	0.1 percent of population in UMFUS license area.
Between 6,000 and 450,000	450 people.
Fewer than 6,000	7.5 percent of population in UMFUS license area.

The PFD contour overlaps several census blocks, all in the County. The County's population totals 375,770 people, according to 2010 U.S. Census Bureau data.[11] As a result, the maximum population permitted within the FSS gateway's -77.6 dBW/m^2/MHz PFD contour is 450 people. Amazon determined that the proposed gateway's PFD contour covers no more than 85 people—less than the 450 limit—using 2010 U.S. Census Bureau data and the actual area method.[12] The gateway's PFD contour, therefore, does not exceed the Section 25.136(a)(ii) aggregate population coverage allowance for the County.

Figure 3 shows the census blocks that are fully or partially covered by the PFD contour. Table 1 shows the total population, fractional area coverage, and fractional population coverage for each fully and partially covered census block. Table 2 shows the total population covered in each county that the PFD contour overlaps.

[11] *See Pinal County, Arizona*, U.S. Census Bureau, https://bit.ly/2PcHeFT (last visited Mar. 11, 2021).

[12] *See* Guidance at 4 (determining estimated aggregate population coverage at bullet 2).

Figure 3. Census Block and Population Coverage of Gateway PFD Contour

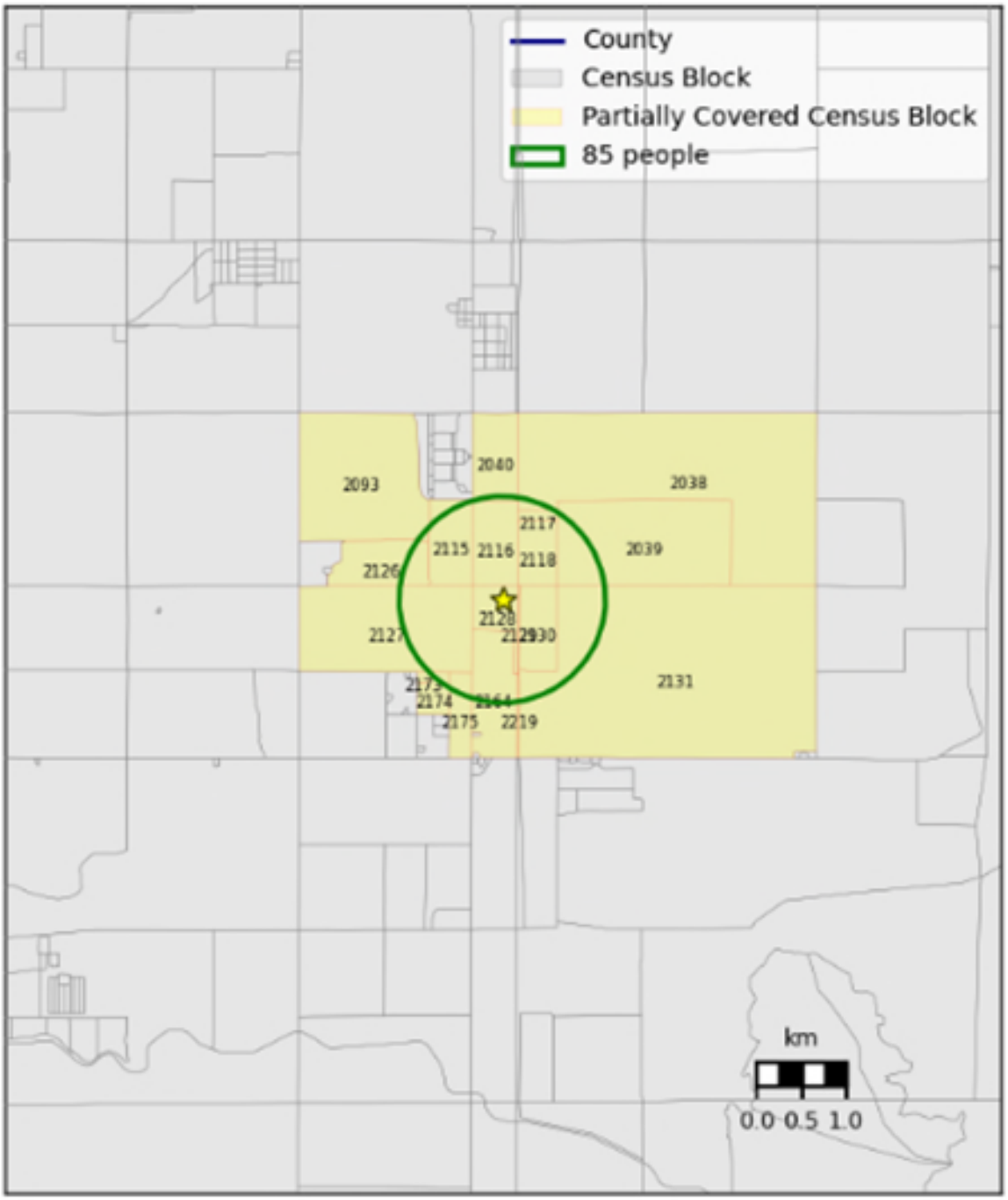


Table 1. PFD Contour Population Coverage, by Census Block

State	County	Block ID	Block Population	Coverage Fraction	Covered Population
Arizona	Pinal	40210012002038	24	1%	0.2
Arizona	Pinal	40210012002039	0	15%	0.0
Arizona	Pinal	40210012002040	0	4%	0.0
Arizona	Pinal	40210012002093	2	0%	0.0
Arizona	Pinal	40210012002115	0	86%	0.0
Arizona	Pinal	40210012002116	0	100%	0.0
Arizona	Pinal	40210012002117	13	99%	12.8
Arizona	Pinal	40210012002118	54	100%	54.0
Arizona	Pinal	40210012002126	0	23%	0.0
Arizona	Pinal	40210012002127	17	38%	6.4
Arizona	Pinal	40210012002128	0	100%	0.0
Arizona	Pinal	40210012002129	0	100%	0.0
Arizona	Pinal	40210012002130	2	100%	2.0
Arizona	Pinal	40210012002131	16	10%	1.5
Arizona	Pinal	40210012002164	8	56%	4.4
Arizona	Pinal	40210012002173	0	0%	0.0
Arizona	Pinal	40210012002174	13	13%	1.7
Arizona	Pinal	40210012002175	10	24%	2.4
Arizona	Pinal	40210012002219	0	32%	0.0

Table 2. PFD Contour Population Coverage, by County

State	County	County Population	Allowable Population Coverage	Covered Population
Arizona	Pinal	375,770	450	85.5

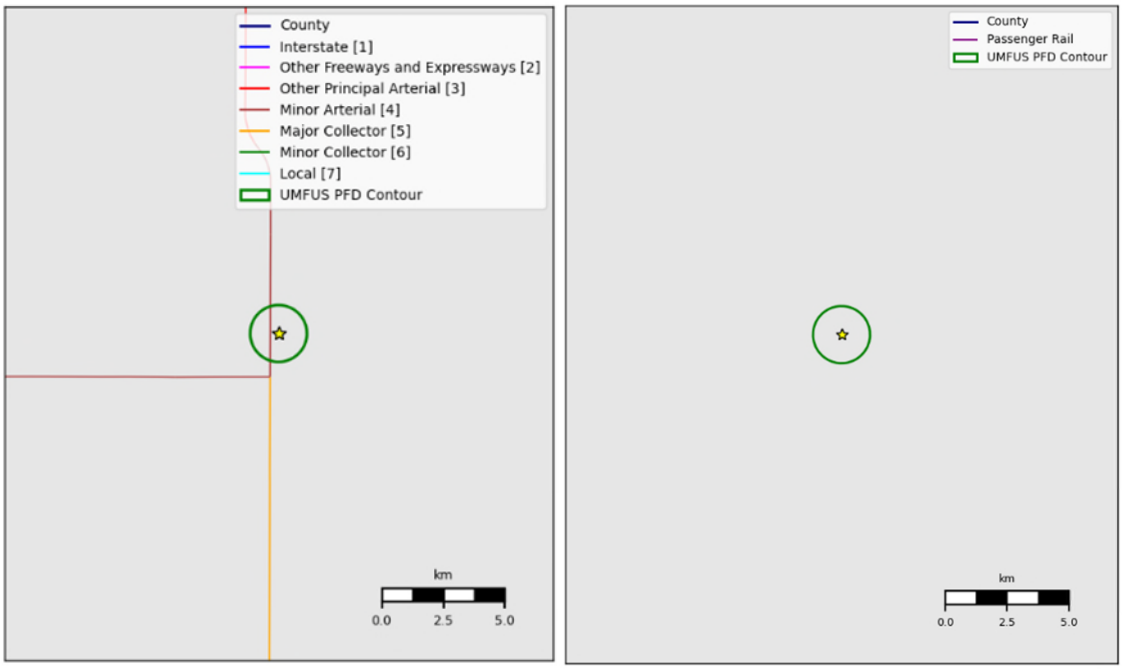
Section 25.136(a)(4)(iii) (major event venue, urban mass transit route, passenger railroad, cruise ship port, Interstate, Other Freeways and Expressways, or Other Principal Arterial in the -77.6 dBm/m^2/MHz PFD contour)

(iii) 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/m^2/MHz does not contain any major event venue, urban mass transit route, passenger railroad, or cruise ship port. In addition, the area mentioned in paragraph (a)(4)(ii) of this section shall not cross any of the following types of roads, as defined in functional classification guidelines issued by the Federal Highway Administration pursuant to 23 CFR 470.105(b): Interstate, Other Freeways and Expressways, or Other Principal Arterial. The Federal Highway Administration Office of Planning, Environment, and Realty Executive Geographic Information System (HEPGIS) map contains information on the classification of roads. For purposes of this rule, an urban area shall be an Adjusted Urban Area as defined in section 101(a)(37) of Title 21 of the United States Code.

Using Google Earth, visual analysis and shapefile data available on data.gov and the U.S. Census Bureau website, Amazon determined that the proposed gateway's -77.6 dBm/m^2/MHz PFD contour does not contain any major event venues, urban mass transit route, passenger railroad, or cruise ship port. As shown in Figure 2 and Figure 4, the PFD contour does not overlap any such infrastructure. Further, the PFD contour does not cross any Interstate, Other Freeways and Expressways, or Other Principal Arterial, as defined by the Federal Highway Administration Office of Planning, Environment, and Realty Executive Geographic Information System.[13] The proposed gateway, therefore, adheres to the requirements of Section 25.136(a)(iii).

[13] *See Planning, Environment, Realty (HEP) HEPGIS*, U.S. Department of Transportation Federal Highway Administration, https://hepgis.fhwa.dot.gov/fhwagis/ (last visited March 23, 2021).

Figure 4. -77.6 dBm/m^2/MHz PFD contour overlaid with major roadways (left) and passenger railroads (right)



Section 25.136(a)(4)(iv) (coordination with existing UMFUS licensees located within a PFD contour greater than or equal to -77.6 dBm/m^2/MHz)

(iv) The applicant has successfully completed frequency coordination with the UMFUS licensees within 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/m^2/MHz with respect to existing facilities constructed and in operation by the UMFUS licensee. In coordinating with UMFUS licensees, the applicant shall use the applicable processes contained in §101.103(d) of this chapter.

Exhibit C, Comsearch Coordination Report, establishes that Amazon has completed coordination with existing UMFUS licensees, as Section 25.136(a)(iv) requires.[14]

[14] *See* 47 C.F.R. § 101.103(d).

EXHIBIT B (RADIATION HAZARD ANALYSIS)

Introduction

In accordance with OET Bulletin 65,[1] this Radiation Hazard Analysis demonstrates that the Amazon 2.4m gateway antennas comply with Commission limits for human exposure to radiofrequency ("RF").

OET Bulletin 65 and section 1.1310 of the Commission's rules specify two separate tiers of maximum permissible exposure ("MPE").[2] The occupational/controlled MPE limit is 5 milliwatts per centimeter squared averaged over any six minute period.[3] The general population/uncontrolled MPE limit is 1 milliwatt per centimeter squared averaged over any thirty minute period.[4]

Amazon calculated the (i) power over the sub-reflector and antenna surface and (ii) near-field and far-field power density for the main and off-axis beams and confirms compliance with both MPE tiers' limits for all regions.

- ***Occupational/controlled exposure.*** This population will not experience harmful radiation levels, as determined by the Commission. The results for the worst-case scenario (near-field, main-beam power density) support this conclusion.
- ***General population/uncontrolled exposure.*** This population will not experience harmful radiation levels, as determined by the Commission. The results for the worst-case scenario (near-field, off-axis power density) support this conclusion. Furthermore, gateways will be deployed in occupational/controlled exposure environments within access-controlled, locked facilities and will be inaccessible to the general population.

Input Parameters

Input Parameter	Unit	Value
Aperture Diameter	meters	2.4
Aperture Radius	meters	1.20
Sub-reflector Diameter	meters	0.408
Sub-reflector Radius	meters	0.204
Aperture Efficiency	Percentage	46%
Frequency	MHz	28750.00
Total Transmitter Power	W	80
Minimum Elevation Angle	degrees	20.00

[1] *See* FCC OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields (Aug. 1997) ("OET Bulletin 65"). Amazon is aware of and will comply with the recently modified rules for radiofrequency exposure that are relevant to fixed earth stations. *See generally Proposed Changes in the Commission's Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields et al.*, Second Report and Order et al., 34 FCC Rcd 11687 (2019).
[2] *See* 47 C.F.R. § 1.1310.
[3] *See* OET Bulletin 65 at Appendix A, Table 1(A).
[4] *See id.* at Appendix A, Table 1(B).

Calculations

Calculated Variables	Unit	Value	Variable	OET Ref
Wavelength	meters	0.01	$\lambda = \frac{c}{f}$	
Area of Reflector	meters^2	4.52	$A = \pi r^2$	
Area of Sub-reflector	meters^2	0.1307	$A_{sub} = \pi r^2$	
Antenna Gain		240499.6	$G = \frac{\eta 4\pi A}{\lambda^2}$	(15)
Antenna Gain	dBi	53.8	$G_{dBi} = 10 * log_{10}(G)$	
Near-Field Distance	meters	138.10	$R_{nf} = \frac{D^2}{4\lambda}$	(12)
Far-Field Distance	meters	331.43	$R_{ff} = \frac{0.6D^2}{\lambda}$	(16)
Far-Field Off-Axis Gain	dBi	-0.53	$G_{ff\ (dBi)} = 29 - 25log_{10}(\theta)$ $\theta = min\ elevation = 20°$	
Far-Field Off-Axis Gain		0.89	$G_{ff} = 10^{(\frac{G_{ff\ (dBi)}}{10})}$	
Power over Sub-reflector	mW/cm^2	244.76	$S_{surface} = \frac{4P}{A_{sub}}$	(11)
Power over Antenna Surface	mW/cm^2	7.07	$S_{surface} = \frac{4P}{A}$	(11)
Near-Field Power Density (Main Beam)	mW/cm^2	3.25	$S_{nf} = \frac{16\eta P}{\pi D^2}$	(13)
Near-Field Power Density (Off-Axis)	mW/cm^2	0.033	$S_{nf} = \frac{16\eta P}{100\pi D^2}$	(13) [5]
Far-Field Max Power Density (Main Beam)	mW/cm^2	1.39	$S_{ff} = \frac{PG}{4\pi R^2}$	(18)
Far-Field Max Power Density (Off-Axis)	mW/cm^2	0.000	$S_{ff\ off-axis} = \frac{PG_{ff}}{4\pi R^2}$	(18) [6]

[5] *See id.* at 30 ("For off-axis calculations in the near-field and in the transition region it can be assumed that, if the point of interest is at least one antenna diameter removed from the center of the main beam, the power density at that point would be at least a factor of 100 (20 dB) less than the value calculated for the equivalent distance in the main beam see Reference [15]).").

[6] *See id.* ("For practical estimation of RF fields in the off-axis vicinity of aperture antennas, use of the antenna radiation pattern envelope can be useful. For example, for the case of an earth station in the fixed-satellite service, the Commission's Rules specify maximum allowable gain for antenna sidelobes not within the plane of the geostationary satellite orbit, such as at ground level. . . . Use of the gain obtained from these relationships in simple far-field calculations, such as Equation 18, will generally be sufficient for estimating RF field levels in the surrounding environment, since the apparent aperture of the antenna is typically very small compared to its frontal area.").

Additional Safety Measures

Access to Amazon's antennas will be carefully controlled. The antennas will be enclosed by a 3m tall fence with locked gates. There will be clear and visible signage that will warn individuals of potential RF exposure risk. Each antenna will have an emergency stop switch that is to be engaged whenever personnel are working on or close to the antenna. The emergency stop switch will disable all RF transmissions from the antenna. All pedestrian gates shall be fully access controlled. Emergency or delivery gates shall be secured with a lock and monitored. Additionally, the transmitter will be turned off during maintenance activities.

Results

In a controlled area accessible to the occupational population, the peak near-field power density (3.25 mW/cm^2) and peak far-field power density (1.39 mW/cm^2) levels do not exceed the MPE limit of 5 mW/cm^2 averaged over a period of six minutes.

In an uncontrolled area accessible to the general population, the off-axis near-field power density (0.033 mW/cm^2) and off-axis far-field power density (0.000 mW/cm^2) levels are below the MPE limit of 1 mW/cm^2 averaged over a period of thirty minutes.[7]

This Radiation Hazard Analysis demonstrates that harmful levels of radiation will not occur in the regions accessible by both the occupational and general populations.

[7] The minimum elevation angle of 20 degrees mostly prohibits the potential for the general population to be affected by the peak power density levels. Additionally, the constant repositioning of the antennas as they track Kuiper System low-earth orbit satellites also ensures that the average power density levels will be significantly reduced when averaged over any six-minute period.

EXHIBIT C (COMSEARCH REPORT)

FREQUENCY COORDINATION AND INTERFERENCE ANALYSIS REPORT

Prepared for
Kuiper Systems LLC.
CASA GRANDE, AZ
Satellite Earth Station

Prepared By:
COMSEARCH
19700 Janelia Farm Boulevard
Ashburn, VA 20147
March 09, 2021

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1. CONCLUSIONS

An interference study considering all existing, proposed and prior coordinated microwave facilities within the coordination contours of the proposed earth station demonstrates that this site will operate satisfactorily with the common carrier microwave environment. Further, there will be no restrictions of its operation due to interference considerations.

2. SUMMARY OF RESULTS

A number of great circle interference cases were identified during the interference study of the proposed earth station. Each of the cases, which exceeded the interference objective on a line-of-sight basis, was profiled and the propagation losses estimated using NBS TN101 (Revised) techniques. The losses were found to be sufficient to reduce the signal levels to acceptable magnitudes in every case.

3. SUPPLEMENTAL SHOWING

Pursuant to Part 25.203(c) of the FCC Rules and Regulations, the satellite earth station proposed in this application was coordinated by Comsearch using computer techniques and in accordance with Part 25 of the FCC Rules and Regulations.

Coordination data for this earth station was sent to the below listed carriers with a letter dated 02/02/2021.

Company
AT&T Corp.
AT&T Mobility Spectrum LLC - AZ
ATC Backhaul LLC
Affiniti LLC
Alltel Comm Southwest Holdings Inc.
Alltel Communications LLC-AZ/CO/NM/NV/UT
American Medical Response, Inc.
American Towers LLC
Arizona Board of Regents Arizona St Univ
Arizona Board of Regents Univ of Arizona
Arizona State University - Tempe
Avondale Police Department
Bluewire LLC
Bolt Internet
Business Only Broadband, LLC
Cable One, Inc.
Casa Grande Union HS Distrist
Cellco Partnership-AZ/CO/NM/NV/UT
Central Yavapai Fire District
City of Avondale
City of Casa Grande
City of Glendale Water Services Wireless
City of Nogales
City of Scottsdale
City of Sedona
City of Surprise
City of Tolleson
City of Tucson IT Department
City of Yuma
Cochise County Government
Commnet Four Corners, LLC
Conterra Ultra Broadband, LLC
Copper Canyon Fire and Medical District
Coppernet Systems, Inc.
Creative Communications Sales & Rentals
Deer Valley Unified School District
Desert Diamond Casino
Desert Mountain Club, Inc
Desert Mountain Master Association
Desert iNET

Drexel Heights Fire District
Dysart Unified School District
Electrical District No 3
Entercom License, LLC
FIF AireBeam, LLC
FiberX LLC
Freeport-McMoRan Bagdad Inc
Freeport-McMoRan Morenci Inc.
GTT Americas LLC
Gila River Cellular General Partnership
Gilmond, Daniel
Global Telecom & Technology Americas
Global Telecom & Technology Americas, In
Golder Ranch Fire District
GovNET Licenses LLC
Gutierrez-Palmenberg, Inc.
Information Services, Inc
J.O. Combs Elementary School Dist #44
KGT LLC
Littleton Unified School District
MTE Communications
Maricopa, City of
Mesa, City of
Multimedia Holdings Corporation
Navajo County
Navopache Electric Cooperative, Inc.
New Cingular Wireless PCS LLC - AZ
North West Fire District
Northland Pioneer College
One Ring Networks, Inc.
Paradise Valley Unified School District
Pendergast School District #92
Peoria, City of
Phoenix, City of
Prescott Valley, Town of
Prescott, City of
Qwest Corporation
Radiology Ltd
Rio Verde Wireless, LLC
SBA Towers IX, LLC
SBI License Corporation
SWWG, LLC
Saddleback Communications
Santa Cruz County
Scottsdale Medical Imaging
Sedona Fire District
Shamrock Foods Company
Simply Bits, LLC
Skyview Networks
Smith Bagley, Inc
Spanish Independent Broadcast Network
Sparkplug Southwest, LLC
SpeedConnect, LLC
Sprint PCS
Sprint Spectrum L.P.
Sprint Spectrum LP DBA Sprint PCS

Sprintcom, Inc
Strategic Technology Communications, Inc
Sun City West Fire District
T-Mobile License LLC
TPT SpeedConnect, LLC
Table Top Telephone Company
Taurus Technology Investment Partners
Telink Networks SW, LLC
Tempe Union High School District #213
Tempe, City of
Texas Telecommunications, LP
Town of Florence
Town of Gilbert, AZ
Transworld Network Corp
Trepic Networks, LLC
Triad Wireless
Tucson Electric Power Company
Union Pacific Railroad Company
Univision Radio Stations Group, Inc.
Valley Telephone Cooperative, Inc.
Western WiMax LLC
XO Communications, LLC
Xiber, LLC

4. EARTH STATION COORDINATION DATA

This section presents the data pertinent to frequency coordination of the proposed earth station that was circulated to all carriers within its coordination contours.

COMSEARCH

Earth Station Data Sheet

19700 Janelia Farm Boulevard, Ashburn, VA 20147
(703)726-5500 http://www.comsearch.com

Date:	03/09/2021
Job Number:	210202COMSGE05

Administrative Information

Status	ENGINEER PROPOSAL
Call Sign	
Licensee Code	KUIPER
Licensee Name	Kuiper Systems LLC.

Site Information — CASA GRANDE, AZ

Venue Name	
Latitude (NAD 83)	32° 53' 34.2" N
Longitude (NAD 83)	111° 30' 43.4" W
Climate Zone	A
Rain Zone	5
Ground Elevation (AMSL)	443.98 m / 1456.6 ft

Link Information

Satellite Type	Low Earth Orbit
Mode	TR - Transmit-Receive
Modulation	Digital
Minimum Elevation Angle	20.0°
Azimuth Range	0.0° to 360°
Antenna Centerline (AGL)	2.74 m / 9.0 ft

Antenna Information		Receive - FCC32		Transmit - FCC32
Manufacturer		Kuiper		Kuiper
Model		Model 24001		Model 24001
Gain / Diameter		49.0 dBi / 2.4 m		52.8 dBi / 2.4 m
3-dB / 15-dB Beamwidth		0.77° / 1.70°		0.49° / 1.17°
Max Available RF Power	(dBW/4 kHz)			-41.0
	(dBW/MHz)			-17.0
Maximum EIRP	(dBW/4 kHz)			14.0
	(dBW/MHz)			38.0
Interference Objectives:	Long Term	-156.0 dBW/MHz	20%	-151.0 dBW/4 kHz 20%
	Short Term	-146.0 dBW/MHz	0.01%	-128.0 dBW/4 kHz 0.0025%

Frequency Information	Receive 18.0 GHz	Transmit 28.0 GHz
Emission / Frequency Range (MHz)	50M0G7D - 500MG7D / 17800.0 - 18600.0 50M0G7D - 500MG7D / 18800.0 - 20200.0	50M0G7D - 500MG7D / 27500.0 - 30000.0
Max Great Circle Coordination Distance	247.0 km / 153.5 mi	25.0 km / 15.5 mi
Precipitation Scatter Contour Radius	100.0 km / 62.1 mi	100.0 km / 62.1 mi

COMSEARCH

Earth Station Data Sheet

19700 Janelia Farm Boulevard, Ashburn, VA 20147
(703)726-5500 http://www.comsearch.com

Coordination Values	**CASA GRANDE, AZ**			
Licensee Name	Kuiper Systems LLC.			
Latitude (NAD 83)	32° 53' 34.2" N			
Longitude (NAD 83)	111° 30' 43.4" W			
Ground Elevation (AMSL)	443.98 m / 1456.6 ft			
Antenna Centerline (AGL)	2.74 m / 9.0 ft			
Antenna Model	Kuiper 2.4 meter			
Antenna Mode	Receive 18.0 GHz		Transmit 28.0 GHz	
Interference Objectives: Long Term	-156.0 dBW/MHz	20%	-151.0 dBW/4 kHz	20%
Short Term	-146.0 dBW/MHz	0.01%	-128.0 dBW/4 kHz	0.0025%
Max Available RF Power		-41.0 (dBW/4 kHz)		

			Receive 18.0 GHz		Transmit 28.0 GHz	
Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
0	0.00	79.14	-0.50	247.00	-0.50	25.00
5	0.00	74.66	-0.50	247.00	-0.50	25.00
10	0.00	70.21	-0.50	247.00	-0.50	25.00
15	0.00	65.80	-0.50	247.00	-0.50	25.00
20	0.00	61.43	-0.50	247.00	-0.50	25.00
25	0.00	57.11	-0.50	247.00	-0.50	25.00
30	0.00	52.88	-0.50	247.00	-0.50	25.00
35	0.00	48.74	-0.50	247.00	-0.50	25.00
40	0.00	44.73	-0.50	247.00	-0.50	25.00
45	0.00	40.89	-0.50	247.00	-0.50	25.00
50	0.00	37.27	-0.50	247.00	-0.50	25.00
55	0.00	33.95	-0.50	247.00	-0.50	25.00
60	0.00	31.03	-0.50	247.00	-0.50	25.00
65	0.00	28.62	-0.50	247.00	-0.50	25.00
70	0.00	26.87	-0.50	247.00	-0.50	25.00
75	0.20	26.12	-0.50	247.00	-0.50	25.00
80	0.21	26.05	-0.50	247.00	-0.50	25.00
85	0.23	26.87	-0.50	247.00	-0.50	25.00
90	0.24	28.49	-0.50	247.00	-0.50	25.00
95	0.25	30.79	-0.50	247.00	-0.50	25.00
100	0.23	33.60	-0.50	247.00	-0.50	25.00
105	0.21	36.83	-0.50	247.00	-0.50	25.00
110	0.20	40.38	-0.50	247.00	-0.50	25.00
115	0.00	44.07	-0.50	247.00	-0.50	25.00
120	0.00	48.05	-0.50	247.00	-0.50	25.00
125	0.00	52.17	-0.50	247.00	-0.50	25.00
130	0.00	56.39	-0.50	247.00	-0.50	25.00
135	0.00	60.70	-0.50	247.00	-0.50	25.00
140	0.00	65.06	-0.50	247.00	-0.50	25.00
145	0.00	69.47	-0.50	247.00	-0.50	25.00
150	0.00	73.91	-0.50	247.00	-0.50	25.00
155	0.00	78.38	-0.50	247.00	-0.50	25.00
160	0.00	82.87	-0.50	247.00	-0.50	25.00
165	0.00	87.37	-0.50	247.00	-0.50	25.00
170	0.00	91.87	-0.50	247.00	-0.50	25.00
175	0.00	96.37	-0.50	247.00	-0.50	25.00
180	0.00	100.86	-0.50	247.00	-0.50	25.00
185	0.00	105.34	-0.50	247.00	-0.50	25.00

COMSEARCH

Earth Station Data Sheet

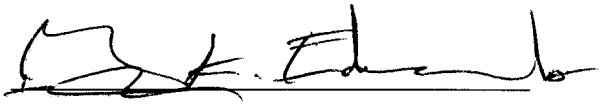
19700 Janelia Farm Boulevard, Ashburn, VA 20147
(703)726-5500 http://www.comsearch.com

Coordination Values	**CASA GRANDE, AZ**			
Licensee Name	Kuiper Systems LLC.			
Latitude (NAD 83)	32° 53' 34.2" N			
Longitude (NAD 83)	111° 30' 43.4" W			
Ground Elevation (AMSL)	443.98 m / 1456.6 ft			
Antenna Centerline (AGL)	2.74 m / 9.0 ft			
Antenna Model	Kuiper 2.4 meter			
Antenna Mode	Receive 18.0 GHz		Transmit 28.0 GHz	
Interference Objectives: Long Term	-156.0 dBW/MHz	20%	-151.0 dBW/4 kHz	20%
Short Term	-146.0 dBW/MHz	0.01%	-128.0 dBW/4 kHz	0.0025%
Max Available RF Power		-41.0 (dBW/4 kHz)		

			Receive 18.0 GHz		Transmit 28.0 GHz	
Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
190	0.00	109.79	-0.50	247.00	-0.50	25.00
195	0.00	114.20	-0.50	247.00	-0.50	25.00
200	0.00	118.57	-0.50	247.00	-0.50	25.00
205	0.00	122.89	-0.50	247.00	-0.50	25.00
210	0.00	127.12	-0.50	247.00	-0.50	25.00
215	0.00	131.26	-0.50	247.00	-0.50	25.00
220	0.00	135.27	-0.50	247.00	-0.50	25.00
225	0.00	139.11	-0.50	247.00	-0.50	25.00
230	0.00	142.73	-0.50	247.00	-0.50	25.00
235	0.00	146.05	-0.50	247.00	-0.50	25.00
240	0.00	148.97	-0.50	247.00	-0.50	25.00
245	0.00	151.38	-0.50	247.00	-0.50	25.00
250	0.00	153.13	-0.50	247.00	-0.50	25.00
255	0.00	154.08	-0.50	247.00	-0.50	25.00
260	0.00	154.16	-0.50	247.00	-0.50	25.00
265	0.00	153.35	-0.50	247.00	-0.50	25.00
270	0.00	151.72	-0.50	247.00	-0.50	25.00
275	0.00	149.42	-0.50	247.00	-0.50	25.00
280	0.00	146.57	-0.50	247.00	-0.50	25.00
285	0.00	143.31	-0.50	247.00	-0.50	25.00
290	0.00	139.74	-0.50	247.00	-0.50	25.00
295	0.00	135.93	-0.50	247.00	-0.50	25.00
300	0.00	131.95	-0.50	247.00	-0.50	25.00
305	0.00	127.83	-0.50	247.00	-0.50	25.00
310	0.00	123.61	-0.50	247.00	-0.50	25.00
315	0.00	119.30	-0.50	247.00	-0.50	25.00
320	0.00	114.94	-0.50	247.00	-0.50	25.00
325	0.00	110.53	-0.50	247.00	-0.50	25.00
330	0.00	106.09	-0.50	247.00	-0.50	25.00
335	0.00	101.62	-0.50	247.00	-0.50	25.00
340	0.00	97.13	-0.50	247.00	-0.50	25.00
345	0.00	92.63	-0.50	247.00	-0.50	25.00
350	0.00	88.13	-0.50	247.00	-0.50	25.00
355	0.00	83.63	-0.50	247.00	-0.50	25.00

5. CERTIFICATION

I HEREBY CERTIFY THAT I AM THE TECHNICALLY QUALIFIED PERSON RESPONSIBLE FOR THE PREPARATION OF THE FREQUENCY COORDINATION DATA CONTAINED IN THIS APPLICATION, THAT I AM FAMILIAR WITH PARTS 101 AND 25 OF THE FCC RULES AND REGULATIONS, THAT I HAVE EITHER PREPARED OR REVIEWED THE FREQUENCY COORDINATION DATA SUBMITTED WITH THIS APPLICATION, AND THAT IT IS COMPLETE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

BY: _ 

Gary K. Edwards
Senior Manager
COMSEARCH
19700 Janelia Farm Boulevard
Ashburn, VA 20147

DATED: March 09, 2021

Ka-Band Earth Station – Casa Grande, AZ

Frequency Coordination Report

28 GHz

Prepared on Behalf of
KUIPER SYSTEMS, LLC

March 30, 2021

COMSEARCH®
A CommScope Company

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2. 28 GHz Common Carrier and LTTS Coordination - 1 -

3. 28 GHz UMFUS Coordination - 2 -

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1. Summary of Results

On behalf of KUIPER SYSTEMS, LLC, Comsearch performed a coordination notice under Section 25.203(c) and Section 25.136(a)(4) of the FCC's rules for all existing and proposed terrestrial licenses within the coordination contours of their proposed Ka-Band earth station in Casa Grande, AZ, which will transmit at 28 GHz[1]. Prior-notification letters were sent to the licensees and a copy of the notification data is provided in section four of this report. The earth station coordination was finalized on March 30, 2021.

There are no unresolved objections from any of the incumbent 28 GHz licensees.

2. 28 GHz Common Carrier and LTTS Coordination

In accordance with FCC Rules and Regulations, the Ka-Band earth station in Casa Grande, AZ was prior-coordinated by Comsearch. A notification letter and datasheets for this earth station were sent to the following 28 GHz common carrier fixed microwave licensees. These licensees are authorized to operate temporary fixed operations from 27.5 – 29.5 GHz on a nationwide basis or local basis.

Licensee	Authorized Geographic Area
Frontier	Nationwide

A notification letter and datasheets for the Ka-Band earth station in Casa Grande, AZ were also sent to the following 28 GHz local television transmission licensee. This licensee is authorized to operate temporary fixed operations from 27.5 – 29.5 GHz on a nationwide basis.

Licensee	Authorized Geographic Area
Information Super Station, LLC	Continental US

No objections were received from the common carrier or local television transmission service incumbents.

[1] The proposed earth station will operate in the 27.5 – 30.0 GHz portion of the Ka-Band.

3. 28 GHz UMFUS Coordination

There was one 28 GHz UMFUS licensee identified within the coordination distance of the proposed earth station. The proposed earth station will operate on frequencies that overlap Channel L1 & L2 of the UMFUS service. The total frequency allocation for Channels L1 & L2 of the UMFUS spectrum appears below.

Channel: **L1** 27.500 - 27.925 GHz
L2 27.925 - 28.350 GHz

Licensee	Authorized Geographic Area
Alta (DISH Networks)[2]	Market Based

There are no Unresolved Objections from the UMFUS incumbents within coordination distance.

[2] Incumbent requested additional information beyond the requirements defined in the FCC rules. No technical objection based on case impacts was received.

4. Earth Station Coordination Data

This section presents the data pertinent to the proposed Ka-Band earth station in Casa Grande, AZ. This data was circulated to all incumbent licensees in the shared 28 GHz frequency ranges.

Job Number:	210202COMSGE05

Administrative Information	
Status	ENGINEER PROPOSAL
Call Sign	
Licensee Code	KUIPER
Licensee Name	Kuiper Systems LLC.

Site Information	**CASA GRANDE, AZ**
Venue Name	
Latitude (NAD 83)	32° 53' 34.2" N
Longitude (NAD 83)	111° 30' 43.4" W
Climate Zone	A
Rain Zone	5
Ground Elevation (AMSL)	443.98 m / 1456.6 ft

Link Information	
Satellite Type	Low Earth Orbit
Mode	TR - Transmit-Receive
Modulation	Digital
Minimum Elevation Angle	20.0°
Azimuth Range	0.0° to 360°
Antenna Centerline (AGL)	2.74 m / 9.0 ft

Antenna Information		**Receive - FCC32**		**Transmit - FCC32**
Manufacturer		Kuiper		Kuiper
Model		Model 24001		Model 24001
Gain / Diameter		49.0 dBi / 2.4 m		53.8 dBi / 2.4 m
3-dB / 15-dB Beamwidth		0.77° / 1.70°		0.49° / 1.17°
Max Available RF Power	(dBW/4 kHz)			-41.0
	(dBW/MHz)			-17.0
Maximum EIRP	(dBW/4 kHz)			12.8
	(dBW/MHz)			36.8
Interference Objectives:	Long Term	-156.0 dBW/MHz	20%	-151.0 dBW/4 kHz 20%
	Short Term	-146.0 dBW/MHz	0.01%	-128.0 dBW/4 kHz 0.0025%

Frequency Information	**Receive 18.0 GHz**	**Transmit 28.0 GHz**
Emission / Frequency Range (MHz)	50M0G7D - 500MG7D / 17800.0 - 18600.0 50M0G7D - 500MG7D / 18800.0 - 20200.0	50M0G7D - 500MG7D / 27500.0 - 30000.0
Max Great Circle Coordination Distance	247.0 km / 153.5 mi	25.0 km / 15.5 mi
Precipitation Scatter Contour Radius	100.0 km / 62.1 mi	100.0 km / 62.1 mi

Coordination Values	**CASA GRANDE, AZ**			
Licensee Name	Kuiper Systems LLC.			
Latitude (NAD 83)	32° 53' 34.2" N			
Longitude (NAD 83)	111° 30' 43.4" W			
Ground Elevation (AMSL)	443.98 m / 1456.6 ft			
Antenna Centerline (AGL)	2.74 m / 9.0 ft			
Antenna Model	Kuiper 2.4 meter			
Antenna Mode	Receive 18.0 GHz		Transmit 28.0 GHz	
Interference Objectives: Long Term	-156.0 dBW/MHz	20%	-151.0 dBW/4 kHz	20%
Short Term 0.0025%	-146.0 dBW/MHz	0.01%	-128.0 dBW/4 kHz	
Max Available RF Power		-41.0 (dBW/4 kHz)		

			Receive 18.0 GHz		Transmit 28.0 GHz	
Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
0	0.00	79.14	-0.50	247.00	-0.50	25.00
5	0.00	74.66	-0.50	247.00	-0.50	25.00
10	0.00	70.21	-0.50	247.00	-0.50	25.00
15	0.00	65.80	-0.50	247.00	-0.50	25.00
20	0.00	61.43	-0.50	247.00	-0.50	25.00
25	0.00	57.11	-0.50	247.00	-0.50	25.00
30	0.00	52.88	-0.50	247.00	-0.50	25.00
35	0.00	48.74	-0.50	247.00	-0.50	25.00
40	0.00	44.73	-0.50	247.00	-0.50	25.00
45	0.00	40.89	-0.50	247.00	-0.50	25.00
50	0.00	37.27	-0.50	247.00	-0.50	25.00
55	0.00	33.95	-0.50	247.00	-0.50	25.00
60	0.00	31.03	-0.50	247.00	-0.50	25.00
65	0.00	28.62	-0.50	247.00	-0.50	25.00
70	0.00	26.87	-0.50	247.00	-0.50	25.00
75	0.20	26.12	-0.50	247.00	-0.50	25.00
80	0.21	26.05	-0.50	247.00	-0.50	25.00
85	0.23	26.87	-0.50	247.00	-0.50	25.00
90	0.24	28.49	-0.50	247.00	-0.50	25.00
95	0.25	30.79	-0.50	247.00	-0.50	25.00
100	0.23	33.60	-0.50	247.00	-0.50	25.00
105	0.21	36.83	-0.50	247.00	-0.50	25.00
110	0.20	40.38	-0.50	247.00	-0.50	25.00
115	0.00	44.07	-0.50	247.00	-0.50	25.00
120	0.00	48.05	-0.50	247.00	-0.50	25.00
125	0.00	52.17	-0.50	247.00	-0.50	25.00
130	0.00	56.39	-0.50	247.00	-0.50	25.00
135	0.00	60.70	-0.50	247.00	-0.50	25.00
140	0.00	65.06	-0.50	247.00	-0.50	25.00
145	0.00	69.47	-0.50	247.00	-0.50	25.00
150	0.00	73.91	-0.50	247.00	-0.50	25.00
155	0.00	78.38	-0.50	247.00	-0.50	25.00
160	0.00	82.87	-0.50	247.00	-0.50	25.00
165	0.00	87.37	-0.50	247.00	-0.50	25.00
170	0.00	91.87	-0.50	247.00	-0.50	25.00
175	0.00	96.37	-0.50	247.00	-0.50	25.00
180	0.00	100.86	-0.50	247.00	-0.50	25.00
185	0.00	105.34	-0.50	247.00	-0.50	25.00

Coordination Values	**CASA GRANDE, AZ**			
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Max Available RF Power		-41.0 (dBW/4 kHz)		

			Receive 18.0 GHz		Transmit 28.0 GHz	
Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
190	0.00	109.79	-0.50	247.00	-0.50	25.00
195	0.00	114.20	-0.50	247.00	-0.50	25.00
200	0.00	118.57	-0.50	247.00	-0.50	25.00
205	0.00	122.89	-0.50	247.00	-0.50	25.00
210	0.00	127.12	-0.50	247.00	-0.50	25.00
215	0.00	131.26	-0.50	247.00	-0.50	25.00
220	0.00	135.27	-0.50	247.00	-0.50	25.00
225	0.00	139.11	-0.50	247.00	-0.50	25.00
230	0.00	142.73	-0.50	247.00	-0.50	25.00
235	0.00	146.05	-0.50	247.00	-0.50	25.00
240	0.00	148.97	-0.50	247.00	-0.50	25.00
245	0.00	151.38	-0.50	247.00	-0.50	25.00
250	0.00	153.13	-0.50	247.00	-0.50	25.00
255	0.00	154.08	-0.50	247.00	-0.50	25.00
260	0.00	154.16	-0.50	247.00	-0.50	25.00
265	0.00	153.35	-0.50	247.00	-0.50	25.00
270	0.00	151.72	-0.50	247.00	-0.50	25.00
275	0.00	149.42	-0.50	247.00	-0.50	25.00
280	0.00	146.57	-0.50	247.00	-0.50	25.00
285	0.00	143.31	-0.50	247.00	-0.50	25.00
290	0.00	139.74	-0.50	247.00	-0.50	25.00
295	0.00	135.93	-0.50	247.00	-0.50	25.00
300	0.00	131.95	-0.50	247.00	-0.50	25.00
305	0.00	127.83	-0.50	247.00	-0.50	25.00
310	0.00	123.61	-0.50	247.00	-0.50	25.00
315	0.00	119.30	-0.50	247.00	-0.50	25.00
320	0.00	114.94	-0.50	247.00	-0.50	25.00
325	0.00	110.53	-0.50	247.00	-0.50	25.00
330	0.00	106.09	-0.50	247.00	-0.50	25.00
335	0.00	101.62	-0.50	247.00	-0.50	25.00
340	0.00	97.13	-0.50	247.00	-0.50	25.00
345	0.00	92.63	-0.50	247.00	-0.50	25.00
350	0.00	88.13	-0.50	247.00	-0.50	25.00
355	0.00	83.63	-0.50	247.00	-0.50	25.00

5. Contact Information

For questions or information regarding the 28 GHz Frequency Coordination Report, please contact:

Contact person:	Dennis Jimeno
Title:	Engineer III, Telecommunications
Company:	Comsearch
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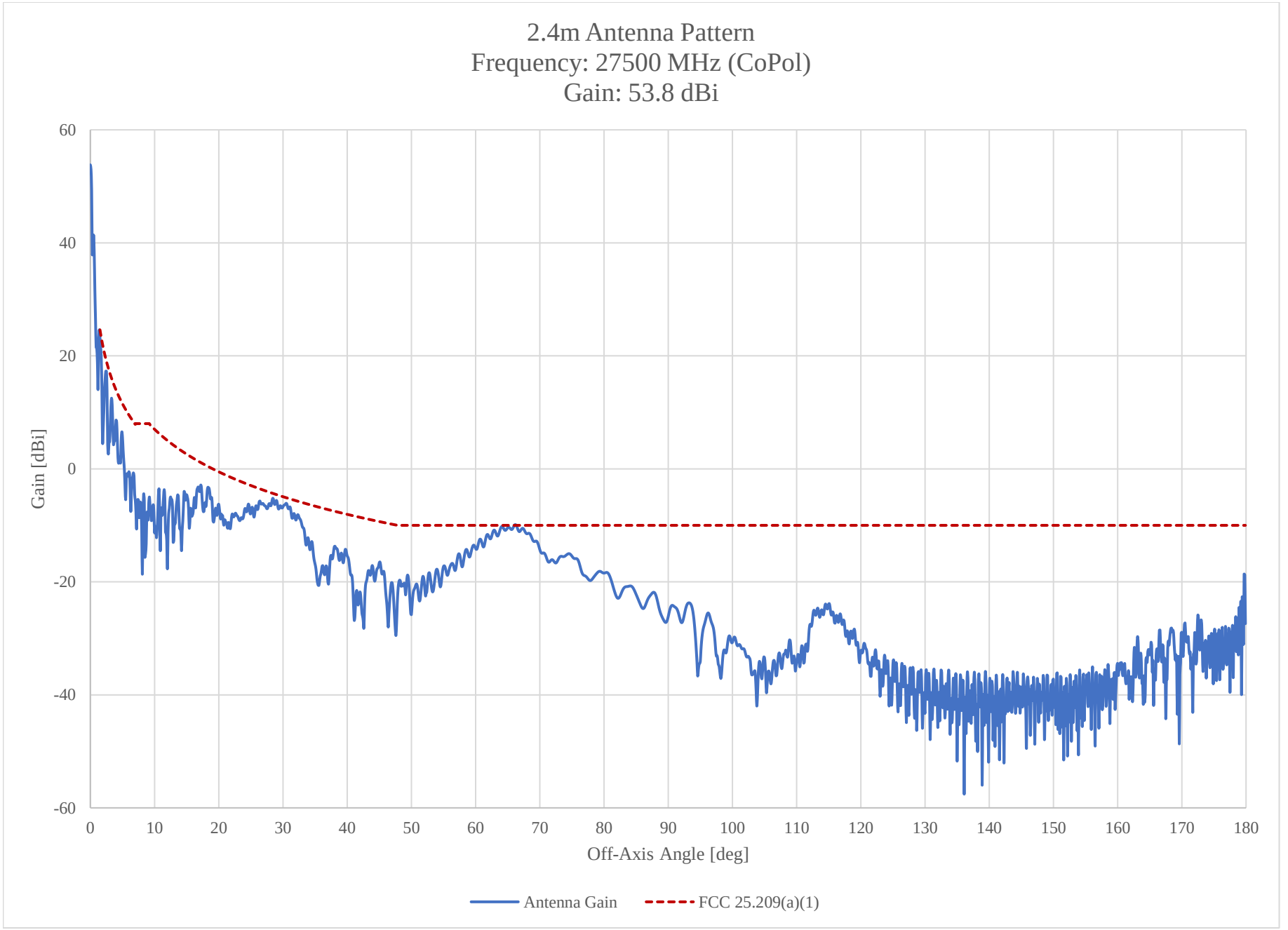
EXHIBIT D (ANTENNA PATTERN)


2.4m Antenna Pattern
Frequency: 27500 MHz (CoPol)
Gain: 53.8 dBi
Gain [dBi]
60
40
20
0
-20
-40
-60
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
Off-Axis Angle [deg]
Antenna Gain
FCC 25.209(a)(1)