



October 5, 2021

VIA IBFS

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
45 L Street, NE
Washington, DC 20554

Re: Kuiper Systems LLC
IBFS File No. SES-LIC-20210409-00635

Dear Ms. Dortch:

Kuiper Systems LLC, a wholly-owned subsidiary of Amazon.com Services LLC (collectively “Amazon”), respectfully submits this letter in response to the Commission’s requests for additional information concerning Amazon’s application to operate a gateway earth station located in Mount Ulla, North Carolina.¹ Specifically, the Commission requested supplementary information regarding shielding, number of antennas, antenna height and position, consideration of state highways in relation to Amazon’s power flux-density (“PFD”) contour, generation of Amazon’s PFD contours, and clutter category used in Amazon’s section 25.136 analysis.² We provide the requested information below.

Shielding Information

Amazon will install a non-perforated corrugated metal fence which will surround the earth station and provide radiofrequency shielding. The fence will consist of a frame (made according to local code requirements) covered with an outer layer made of corrugated steel or aluminum. Most frames will be constructed from metal poles or pressure treated lumber. The fence’s outer layer will be constructed of solid corrugated metal panels fastened with screws to the frame. The fence will be at least 3.048 meters (10 feet) in height and will be located at a minimum distance of 6.5 meters from the antenna. As noted in the application, this shielding solution will provide a minimum of 15 dB of attenuation on the gateway transmissions—a conservative assumption as Amazon anticipates that a higher attenuation is more likely.

The achieved shielding attenuation is partially a function of the difference in heights between the antenna centerline and the shielding fence. Amazon performed two types of analyses to determine the expected shielding attenuation using various antenna and shielding heights. First, Amazon considered the shielding attenuation using a single knife-edge obstacle diffraction model in accordance with ITU-R

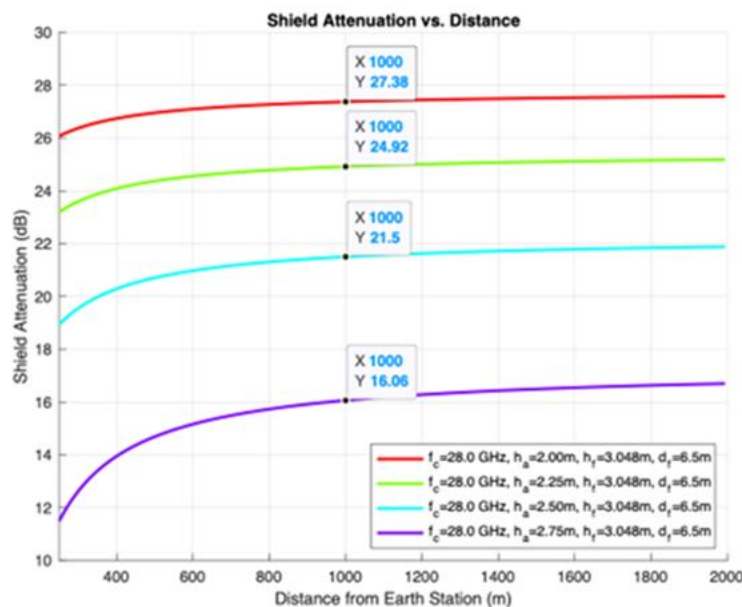
¹ See Application of Kuiper Systems LLC, IBFS File No. SES-LIC-20210409-00635 (filed Mar. 31, 2021), <https://bit.ly/3ikd2au>.

² See 47 C.F.R. § 25.136.

Recommendation P.526-15. Second, Amazon computed the differences in electromagnetic field strengths at the horizon with and without fencing using commercial software (TICRA Tools GRASP) implementing 3-D numerical techniques.

The antenna centerline height varies depending on the antenna elevation and azimuth angles because of its 2-axis X/Y mount design. The antenna centerline height listed in Amazon's coordination notice (Exhibit C), 2.74 meters, is the height of the reflector center when pointing at zenith (straight up). However, at minimum elevation – where the PFD measured at 10 meters above ground level will be at its highest – Amazon's antenna centerline height will vary between 1.9 meters and 2.5 meters, depending on the azimuth.

The results from an analysis based on a single knife-edge diffraction is provided in the figure below. The vertical axis indicates the predicted levels of shielding attenuation that will be achieved while the horizontal axis shows the horizontal distance from the earth station where the shielding effects will be observed at a height of 10 meters above the ground. Each curve represents a different antenna centerline height configuration in the range of 2.0 meters to 2.75 meters above ground (see legend). In each case, the fence is assumed to be the minimum 3.048 meters tall with a horizontal distance of 6.5 meters from the antenna. The results show that the shielding will attenuate the signal by at least 15 dB with an antenna in a zenith pointing orientation, and the shielding will be more effective when the antenna is pointed at its minimum elevation.



Number of Antennas

The gateway will have six antennas, but no more than four antennas will transmit on the same channel at any given time. The additional antennas will be used to reduce downtime by being passively pre-positioned to begin communicating with a rising satellite immediately after an active satellite sets. The extra antennas will also be used to ensure earth station availability in the event of an antenna failure.

Antenna Height and Antenna Position

Amazon notes that in Form 312, Schedule B, field E35 (Above Ground Level (meters)), of our application, Amazon stated that the antenna would be 2.74 meters. Amazon would like to clarify that the maximum overall height of the antenna structure is about 4 meters above ground level.

In relation to the table on Exhibit A, p.3, of our application, Amazon notes that the table shows truncated latitude/longitude coordinates compared to those included in Form 312, Schedule B and Exhibit C (Comsearch Report). The truncated latitude and longitude values in the Exhibit A table are the result of formatting. Our section 25.136 analysis was performed with the latitude/longitude position Amazon included in Form 312, Schedule B and Exhibit C (Comsearch Report).

Consideration of State Highways

Amazon has checked the North Carolina Department of Transportation classification guide³ and confirmed that the PFD contour for the Mount Ulla, North Carolina site does not overlap with any state Freeways and Expressways or Other Principal Arterials.

Generation of Amazon's PFD Contours

Amazon's PFD contours are generated using Visualyse Pro and internal software. Amazon's internal software uses a similar methodology to that of Visualyse Pro and allows us to automate the analysis of multiple sites and under multiple configurations. Both Visualyse Pro and Amazon's internal software create a raster grid of measurement points surrounding the transmitting earth station. Amazon uses a raster that is 10 kilometers wide and with measurement points every 10 to 50 meters. The measurement points represent potential receive antennas surrounding the transmit location. These measurement points are located 10 meters above ground, consistent with sections 25.136(a)(4)(ii) and 25.136(a)(4)(iii) of the Commission's rules.⁴

Clutter Category for ITU-R Recommendation P.452

Amazon used the ITU-R Recommendation P.452 propagation model for its section 25.136 analysis.⁵ In its analysis, Amazon used the lowest clutter category from Table 4 of ITU-R P.452 (high crop fields, park land, irregularly spaced sparse trees, orchard, sparse houses). Visual inspection of the area shows that trees measuring greater than four meters surround the area, making the use of this clutter category a conservative assumption.

In the event the actual antenna gain pattern exceeds the calculated gain levels in the application, or the shielding attenuation achieved falls below the required levels, Amazon will ensure that the PFD contour resulting from the actual antenna and shielding configuration continues to meet all of the criteria specified

³ See NCDOT 2020-2029 STIP Map, North Carolina Department of Transportation, <https://bit.ly/39OhXfk> (last visited Sept. 29, 2021).

⁴ See 47 C.F.R. § 25.136(a)(4)(ii)-(iii).

⁵ See 47 C.F.R. § 25.136.

in sections 25.136(a)(4)(ii) and 25.136(a)(4)(iii) of the Commission's rules.⁶ The International Bureau has similarly conditioned other satellite operators' earth station licenses in the 27.5-28.35 GHz band.⁷

As support for the statements made in this letter, the KML file for this application is attached.

Please contact me with any questions.

Respectfully submitted,

/s/ Liliana Farfan Roach

Liliana Farfan Roach
Corporate Counsel
Kuiper Systems LLC,
an Amazon subsidiary

⁶ See 47 C.F.R. § 25.136(a)(4)(ii)-(iii).

⁷ As an example, the International Bureau granted SpaceX's Prosser, WA application with the following conditions: (a) 90530 - The earth station licensee is required to take corrective action to mitigate interference in the 27.5-28.35 GHz frequency band if the actual PFD, at ten meters above ground level, exceeds -77 .6 dBm/m2/MHz anywhere outside the contour specified in the application; and (b) 90573 - To the extent that the actual gain pattern of the antenna ultimately deployed by the licensee exceeds the antenna mask used in the calculation of the PFD contour, the contour resulting from the actual antenna pattern must continue to meet all of the criteria specified in 47 CFR § 25.136(a)(4)(i-iv). See SpaceX Services, Inc., Grant, IBFS File No. SES-LIC-20200701-00687 (granted July 9, 2021), <https://bit.ly/3CdnA2L>.

Approved by OMB
3060-0678

Date & Time Filed:
File Number: ---
Callsign/Satellite ID:

APPLICATION FOR EARTH STATION AUTHORIZATIONS

**FCC 312 MAIN FORM
FOR OFFICIAL USE ONLY**

FCC Use Only**APPLICANT INFORMATION**

Enter a description of this application to identify it on the main menu:

Amazon - Mount Ulla, NC Gateway 03.31.21

1-8. Legal Name of Applicant

Name: Kuiper Systems LLC Phone Number: 203-856-8528
DBA Name: Fax Number:
Street: 410 Terry Avenue North E-Mail: kuiper-regulatory-contact@amazon.com
City: Seattle State: WA
Country: USA Zipcode: 98109 -
Attention: Will Lewis

9-16. Name of Contact Representative

Name: Will Lewis Phone Number: 203-856-8528
Company: Kuiper Systems LLC Fax Number:
Street: 1800 South Bell Street E-Mail: kuiper-regulatory-contact@amazon.com
City: Arlington State: VA
Country: USA Zipcode: 22202-
Attention: Relationship:

CLASSIFICATION OF FILING

17. Choose the button next to the classification that applies to this filing for both questions a. and b. Choose only one for 17a and only one for 17b.

a.

☒ a1. Earth Station
(N/A) a2. Space Station

b.

- ☒ b1. Application for License of New Station
☐ b2. Application for Registration of New Domestic Receive-Only Station
(N/A) b3. Amendment to a Pending Application
(N/A) b4. Modification of License or Registration
(N/A) b5. Assignment of License or Registration
(N/A) b6. Transfer of Control of License or Registration
(N/A) b7. Notification of Minor Modification
(N/A) b8. Application for License of New Receive-Only Station Using Non-U.S. Licensed Satellite
(N/A) b9. Letter of Intent to Use Non-U.S. Licensed Satellite to Provide Service in the United States
☐ b10. Other (Please specify)
☐ b11. Application for Earth Station to Access a Non-U.S. satellite Not Currently Authorized to Provide the Proposed Service in the Proposed Frequencies in the United States.

17c. Is a fee submitted with this application?

☒ If Yes, complete and attach FCC Form 159.

If No, indicate reason for fee exemption (see 47 C.F.R. Section 1.1114).

☐ Governmental Entity ☐ Noncommercial educational licensee

☐ Other(please explain):

17d.

Fee Classification BAX - Fixed Satellite Transmit/Receive Earth Station

18. If this filing is in reference to an existing station, enter:

(a) Call sign of station:
Not Applicable

19. If this filing is an amendment to a pending application enter:

(a) Date pending application was filed:

(b) File number of pending application:

Not Applicable

Not Applicable

TYPE OF SERVICE

20. NATURE OF SERVICE: This filing is for an authorization to provide or use the following type(s) of service(s): Select all that apply:

- ☒ a. Fixed Satellite
☒ b. Mobile Satellite
☐ c. Radiodetermination Satellite
☐ d. Earth Exploration Satellite
☐ e. Direct to Home Fixed Satellite
☐ f. Digital Audio Radio Service
☐ g. Other (please specify)

21. STATUS: Choose the button next to the applicable status. Choose only one.

☐ Common Carrier ☒ Non-Common Carrier

22. If earth station applicant, check all that apply.

- ☒ Using U.S. licensed satellites
☐ Using Non-U.S. licensed satellites

23. If applicant is providing INTERNATIONAL COMMON CARRIER service, see instructions regarding Sec. 214 filings. Choose one. Are these facilities:

☐ Connected to a Public Switched Network ☐ Not connected to a Public Switched Network ☒ N/A

24. FREQUENCY BAND(S): Place an "X" in the box(es) next to all applicable frequency band(s).

- ☐ a. C-Band (4/6 GHz) ☐ b. Ku-Band (12/14 GHz)
☒ c. Other (Please specify upper and lower frequencies in MHz.)

Frequency Lower: 17800 Frequency Upper: 30000

TYPE OF STATION

25. CLASS OF STATION: Choose the button next to the class of station that applies. Choose only one.

- ☒ a. Fixed Earth Station
☐ b. Temporary-Fixed Earth Station
☐ c. 12/14 GHz VSAT Network
☐ d. Mobile Earth Station
(N/A) e. Geostationary Space Station
(N/A) f. Non-Geostationary Space Station
☐ g. Other (please specify)

26. TYPE OF EARTH STATION FACILITY: Choose only one.

☒ Transmit/Receive ☐ Transmit-Only ☐ Receive-Only ☐ N/A

PURPOSE OF MODIFICATION

27. The purpose of this proposed modification is to: (Place an 'X' in the box(es) next to all that apply.)

Not Applicable

ENVIRONMENTAL POLICY

28. Would a Commission grant of any proposal in this application or amendment have a significant environmental impact as defined by 47 CFR 1.1307? If YES, submit the statement as required by Sections 1.1308 and 1.1311 of the Commission's rules, 47 C.F.R. §§ 1.1308 and 1.1311, as an exhibit to this application. A Radiation Hazard Study must accompany all applications for new transmitting facilities, major modifications, or major amendments.

☐ Yes ☒ No

ALIEN OWNERSHIP Earth station applicants not proposing to provide broadcast, common carrier, aeronautical

en route or aeronautical fixed radio station services are not required to respond to Items 30-34.

29. Is the applicant a foreign government or the representative of any foreign government?	<input type="radio"/> Yes <input checked="" type="radio"/> No
30. Is the applicant an alien or the representative of an alien?	<input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> N/A
31. Is the applicant a corporation organized under the laws of any foreign government?	<input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> N/A
32. Is the applicant a corporation of which more than one-fifth of the capital stock is owned of record or voted by aliens or their representatives or by a foreign government or representative thereof or by any corporation organized under the laws of a foreign country?	<input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> N/A
33. Is the applicant a corporation directly or indirectly controlled by any other corporation of which more than one-fourth of the capital stock is owned of record or voted by aliens, their representatives, or by a foreign government or representative thereof or by any corporation organized under the laws of a foreign country?	<input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> N/A
34. If any answer to questions 29, 30, 31, 32 and/or 33 is Yes, attach as an exhibit an identification of the aliens or foreign entities, their nationality, their relationship to the applicant, and the percentage of stock they own or vote.	

BASIC QUALIFICATIONS

35. Does the Applicant request any waivers or exemptions from any of the Commission's Rules? If Yes, attach as an exhibit, copies of the requests for waivers or exceptions with supporting documents.	<input type="radio"/> Yes <input checked="" type="radio"/> No
36. Has the applicant or any party to this application or amendment had any FCC station authorization or license revoked or had any application for an initial, modification or renewal of FCC station authorization, license, or construction permit denied by the Commission? If Yes, attach as an exhibit, an explanation of circumstances.	<input type="radio"/> Yes <input checked="" type="radio"/> No
37. Has the applicant, or any party to this application or amendment, or any party directly or indirectly controlling the applicant ever been convicted of a felony by any state or federal court? If Yes, attach as an exhibit, an explanation of circumstances.	<input type="radio"/> Yes <input checked="" type="radio"/> No
38. Has any court finally adjudged the applicant, or any person directly or indirectly controlling the applicant, guilty of unlawfully monopolizing or attempting unlawfully to monopolize radio communication, directly or indirectly, through control of manufacture or sale of radio apparatus, exclusive traffic arrangement or any other means or unfair methods of competition? If Yes, attach as an exhibit, an explanation of circumstances.	<input type="radio"/> Yes <input checked="" type="radio"/> No
39. Is the applicant, or any person directly or indirectly controlling the applicant, currently a party in any pending matter referred to in the preceding two items? If yes, attach as an exhibit, an explanation of the circumstances.	<input type="radio"/> Yes <input checked="" type="radio"/> No
40. If the applicant is a corporation and is applying for a space station license, attach as an exhibit the names, address, and citizenship of those stockholders owning a record and/or voting 10 percent or more of the Filer's voting stock and the percentages so held. In the case of fiduciary control, indicate the beneficiary(ies) or class of beneficiaries. Also list the names and addresses of the officers and directors of the Filer.	
41. By checking Yes, the undersigned certifies, that neither applicant nor any other party to the application is subject to a denial of Federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Act of 1988, 21 U.S.C. Section 862, because of a conviction for possession or distribution of a controlled substance. <i>See 47 CFR 1.2002(b) for the meaning of "party to the application" for these purposes.</i>	<input checked="" type="radio"/> Yes <input type="radio"/> No
42a. Does the applicant intend to use a non-U.S. licensed satellite to provide service in the United States? If Yes, answer 42b and attach an exhibit providing the information specified in 47 C.F.R. 25.137, as appropriate. If No, proceed to question 43.	<input type="radio"/> Yes <input checked="" type="radio"/> No
42b. What administration has licensed or is in the process of licensing the space station? If no license will be issued, what administration has coordinated or is in the process of coordinating the space station? N/A	
43. Description. (Summarize the nature of the application and the services to be provided). Applicant seeks authority for its Mount Ulla, NC gateway earth station to use Ka-band frequencies.	

43a. Geographic Service Rule Certification

☒ A

By selecting A, the undersigned certifies that the applicant is not subject to the geographic service or geographic coverage requirements specified in 47 C.F.R. Part 25.

By selecting B, the undersigned certifies that the applicant is subject to the geographic service or geographic coverage requirements specified in 47 C.F.R. Part 25 and will comply with such requirements.

☐ B

By selecting C, the undersigned certifies that the applicant is subject to the geographic service or geographic coverage requirements specified in 47 C.F.R. Part 25 and will not comply with such requirements because it is not feasible as a technical matter to do so, or that, while technically feasible, such services would require so many compromises in satellite design and operation as to make it economically unreasonable. A narrative description and technical analysis demonstrating this claim are attached.

☐ C

CERTIFICATION

The Applicant waives any claim to the use of any particular frequency or of the electromagnetic spectrum as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise, and requests an authorization in accordance with this application. The applicant certifies that grant of this application would not cause the applicant to be in violation of the spectrum aggregation limit in 47 CFR Part 20. All statements made in exhibits are a material part hereof and are incorporated herein as if set out in full in this application. The undersigned, individually and for the applicant, hereby certifies that all statements made in this application and in all attached exhibits are true, complete and correct to the best of his or her knowledge and belief, and are made in good faith.

44. Applicant is a (an): (Choose the button next to applicable response.)

- ☐ Individual
☐ Unincorporated Association
☐ Partnership
☐ Corporation
☐ Governmental Entity
☒ Other (please specify)
Limited Liability Company

45. Name of Person Signing
Will Lewis

46. Title of Person Signing
Corporate Counsel

47. Please supply any need attachments.

Attachment 1:

Attachment 2:

Attachment 3:

**WILLFUL FALSE STATEMENTS MADE ON THIS FORM ARE PUNISHABLE BY FINE AND / OR IMPRISONMENT
(U.S. Code, Title 18, Section 1001), AND/OR REVOCATION OF ANY STATION AUTHORIZATION
(U.S. Code, Title 47, Section 312(a)(1)), AND/OR FORFEITURE (U.S. Code, Title 47, Section 503).**

**SATELLITE EARTH STATION AUTHORIZATIONS
FCC Form 312 - Schedule B:(Technical and Operational Description)**

FOR OFFICIAL USE ONLY

Location of Earth Station Site

E1: Site Identifier: Mount Ulla Gateway

E5. Call Sign:

E2: Contact Name Cat DeLeonardis

E6. Phone Number: 206-646-2992

E3. Street:

E7. City: Mount Ulla

E8. County: Rowan

E4. State NC

E9. Zip Code

E10. Area of Operation:

Mount Ulla, NC

E11. Latitude: 35 ° 38 ' 58.2 " N

E12. Longitude: 80 ° 40 ' 5.3 " W

E13. Lat/Lon Coordinates are: ☐ NAD-27 ☒ NAD-83 ☐ N/A

E14. Site Elevation (AMSL): 246.43 meters

E15. If the proposed antenna(s) operate in the Fixed Satellite Service (FSS) with geostationary satellites, do(es) the proposed antenna(s) comply with the antenna gain patterns specified in Section 25.209(a) and (b) as demonstrated by the manufacturer's qualification measurement? If NO, provide a technical analysis showing compliance with two-degree spacing policy.	<input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> N/A
E16. If the proposed antenna(s) do not operate in the Fixed Satellite Service (FSS), or if they operate in the Fixed Satellite Service (FSS) with non-geostationary satellites, do(es) the proposed antenna(s) comply with the antenna gain patterns specified in Section 25.209(a2) and (b) as demonstrated by the manufacturer's qualification measurements?	<input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> N/A
E17. Is the facility operated by remote control? If YES, provide the location and telephone number of the control point.	<input checked="" type="radio"/> Yes <input type="radio"/> No
E18. Is frequency coordination required? If YES, attach a frequency coordination report as	<input checked="" type="radio"/> Yes <input type="radio"/> No
E19. Is coordination with another country required? If YES, attach the name of the country(ies) and plot of coordination contours as	<input type="radio"/> Yes <input checked="" type="radio"/> No
E20. FAA Notification - (See 47 CFR Part 17 and 47 CFR part 25.113(c)) Where FAA notification is required, have you attached a copy of a completed FCC Form 854 and or the FAA's study regarding the potential hazard of the structure to aviation? FAILURE TO COMPLY WITH 47 CFR PARTS 17 AND 25 WILL RESULT IN THE RETURN OF THIS APPLICATION.	<input type="radio"/> Yes <input checked="" type="radio"/> No

POINTS OF COMMUNICATION

Satellite Name: OTHER OTHER If you selected OTHER, please enter the following:	
E21. Common Name: Kuiper (S3051)	E22. ITU Name: USASAT-NGSO-8A/8B/8C
E23. Orbit Location: NGSO	E24. Country: USA

POINTS OF COMMUNICATION (Destination Points)

E25. Site Identifier: Mount Ulla Gateway	
E26. Common Name:	E27. Country: USA

ANTENNA

Site ID	E28. Antenna Id	E29. Quantity	E30. Manufacturer	E31. Model	E32. Antenna Size	E41/42. Antenna Gain Transmint and/or Recieve(____dBi at ____GHz)		
Mount Ulla Gateway	AMZN-2.4M	6	Kuiper	24001	2.4	49.0 dBi at 17.8		
						53.8 dBi at 27.5		

E28. Antenna Id	E33/34. Diameter Minor/Major(meters)	E35. Above Ground Level (meters)	E36. Above Sea Level (meters)	E37. Building Height Above Ground Level (meters)	E38. Total Input Power at antenna flange (Watts)	E39. Maximum Antenna Height Above Rooftop (meters)	E40. Total EIRP for al carriers (dBW)
AMZN-2.4M	2.4/2.4	2.74	246.43	0.0	100.0	0.0	73.8

FREQUENCY

E28.	E43/44.	E45.	E46. Antenna	E47.	E48. Maximum	E49. Maximum EIRP
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Antenna Id	Frequency Bands(MHz)	T/R Mode	Polarization(H,V,L,R)	Emission Designator	EIRP per Carrier(dBW)	Density per Carrier(dBW/4kHz)
AMZN-2.4M	17800 18600	R	Left and Right Circular	100MG7D	0.0	0.0
E50. Modulation and Services BPSK up to 64 QAM; Digital Data						
AMZN-2.4M	17800 18600	R	Left and Right Circular	500MG7D	0.0	0.0
E50. Modulation and Services BPSK up to 64 QAM; Digital Data						
AMZN-2.4M	18800 20200	R	Left and Right Circular	100MG7D	0.0	0.0
E50. Modulation and Services BPSK up to 64 QAM; Digital Data						
AMZN-2.4M	18800 20200	R	Left and Right Circular	500MG7D	0.0	0.0
E50. Modulation and Services BPSK up to 64 QAM; Digital Data						
AMZN-2.4M	27500 30000	T	Left and Right Circular	500MG7D	63.8	12.8
E50. Modulation and Services BPSK up to 512QAM; Digital Data						
AMZN-2.4M	27500 30000	T	Left and Right Circular	50M0G7D	53.8	12.8
E50. Modulation and Services BPSK up to 512QAM; Digital Data						

FREQUENCY COORDINATION

E28. Antenna Id	E51. Satellite Orbit Type	E52/53. Frequency Limits(MHz)	E54/55. Range of Satellite Arc E/W Limit	E56. Earth Station Azimuth Angle Eastern Limit	E57. Antenna Elevation Angle Eastern Limit	E58. Earth Station Azimuth Angle Western Limit	E59. Antenna Elevation Angle Western Limit	E60. Maximum EIRP Density toward the Horizon(dBW/4kHz)
AMZN-2.4M	Non-Geostationary	17800 18600	0.0/360.0	0.0	20.0	360.0	20.0	-41.5
	Non-Geostationary	18800 20200	0.0/360.0	0.0	20.0	360.0	20.0	-41.5
	Non-Geostationary	27500 30000	0.0/360.0	0.0	20.0	360.0	20.0	-41.5

REMOTE CONTROL POINT LOCATION

REMOTE CONTROL POINT LOCATION

E61. Call Sign NOTE: Please enter the callsign of the controlling station, not the callsign for which this application is being filed.		E65. Phone Number 206-646-2992	
E62. Street Address 18460 NE 76th Street			
E63. City Redmond	E67. County King	E64/68. State/Country WA/ USA	E66. Zip Code 98052

FCC NOTICE REQUIRED BY THE PAPERWORK REDUCTION ACT

The public reporting for this collection of information is estimated to average 0.25 - 24 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the

required data, and completing and reviewing the collection of information. If you have any comments on this burden estimate, or how we can improve the collection and reduce the burden it causes you, please write to the Federal Communications Commission, AMD-PERF, Paperwork Reduction Project (3060-0678), Washington, DC 20554. We will also accept your comments regarding the Paperwork Reduction Act aspects of this collection via the Internet if you send them to PRA@fcc.gov. PLEASE DO NOT SEND COMPLETED FORMS TO THIS ADDRESS.

Remember - You are not required to respond to a collection of information sponsored by the Federal government, and the government may not conduct or sponsor this collection, unless it displays a currently valid OMB control number or if we fail to provide you with this notice. This collection has been assigned an OMB control number of 3060-0678.

THE FOREGOING NOTICE IS REQUIRED BY THE PAPERWORK REDUCTION ACT OF 1995, PUBLIC LAW 104-13, OCTOBER 1, 1995, 44 U.S.C. SECTION 3507.

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 Mount Ulla, NC. 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 License⁴ 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)	Status⁵
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 service¹⁵ 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)	Status²⁰
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 service²⁹ and employ the section 25.261 spectrum-sharing framework with NGSO system operators in the March 2020 processing round while operating service.³⁰

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 service³² 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

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 Rowan County, NC (“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/m²/MHz at 10 meters above ground level, 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 (“-77.6 dBm/m²/MHz”).² *Third*, the -77.6 dBm/m²/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/m²/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 gateway. Amazon’s -77.6 dBm/m²/MHz PFD contour covers no more than 15 people of the County’s total 138,428 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 gateway and not require Amazon to provide additional interference protection to UMFUS licensees in this County.

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).

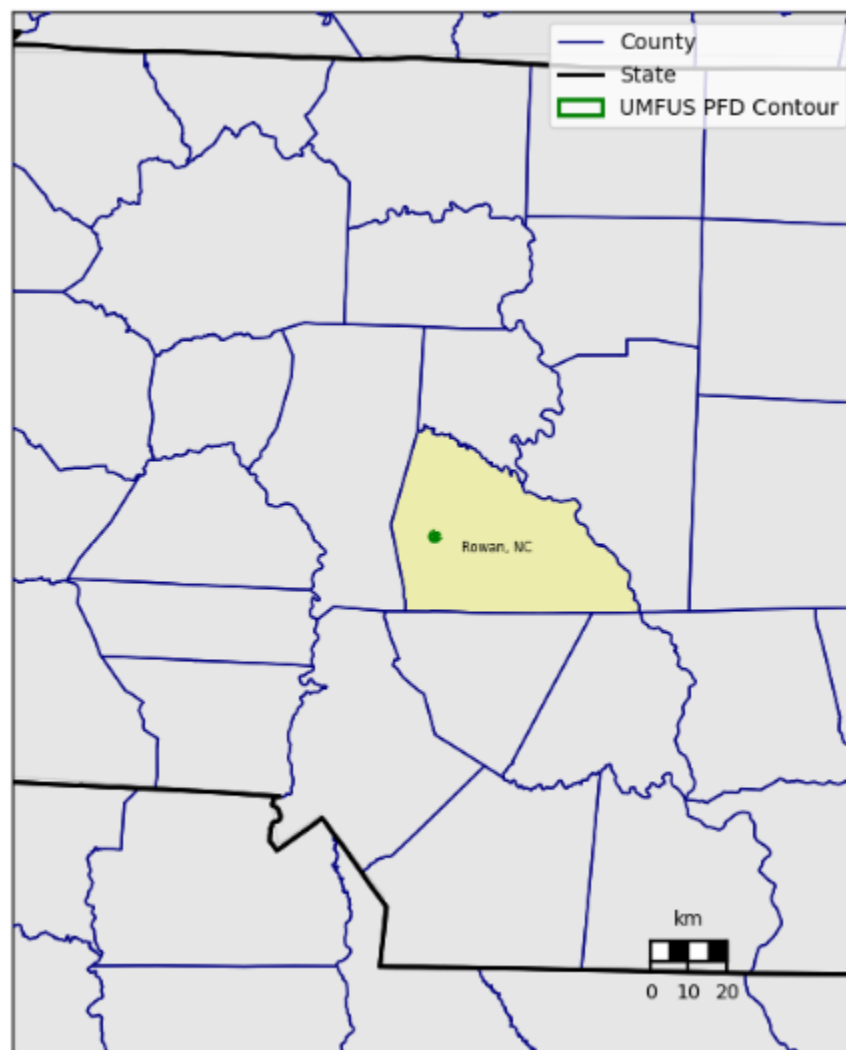
³ See Exhibit C, Comsearch Coordination Report.

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 Amazon gateway's location in the County. As of the date of this submission, the Commission's International Bureau Filing System shows one geostationary orbit FSS licensee, Viasat, using 27.5-28.35 GHz in the County: call sign E160116, which the Commission authorized and grandfathered in 2017 ("E160116").⁴ Amazon's gateway will collocate with the existing E160116 gateway and satisfies Section 25.136(a)(4)(i).

Figure 1. Location of Amazon Gateway



⁴ See License, IBFS File No. SES-LIC-20160610-00546 (granted Jan. 19, 2017).

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

To verify compliance, Amazon generated the new Amazon gateway PFD contour, existing E160116 gateway PFD contour, and aggregate gateway PFD contour (new Amazon gateway PFD contour and existing E160116 gateway PFD contour).

New Amazon gateway PFD contour. 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.⁵ The shielding solution will entirely surround the new Amazon 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	Rowan County, NC	
Coordinates	35.65N, -80.67W	
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) ⁶	-16.2	dBW/MHz
Aggregate EIRP toward the Horizon (with Shielding) ⁷	-31.2	dBW/MHz

Amazon generated the gateway’s -77.6 dBW/m²/MHz PFD contour using proprietary satellite communications and geospatial analysis software and verified the results using Visualize 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.⁸ The antenna gain toward the horizon is derived from antenna manufacturer simulations and complies with the section 25.209(a)(1)⁹ antenna gain masks for all

⁵ See Guidance at 3 (computing PFD contours and protection zones at bullet 4).

⁶ 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.

⁷ This figure is the Aggregate EIRP toward the Horizon (without Shielding) minus an additional 15 dB of attenuation for shielding.

⁸ See Guidance at 3 (computing PFD contours and protection zones at bullets 2 and 4).

⁹ See 47 C.F.R. § 25.209(a)(1); see also Guidance at 3 (computing PFD contours and protection zones at bullet 3).

off-axis angles.¹⁰ The PFD contour is generated using the worst case input power density rather than the input power density during clear sky conditions.¹¹

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

Existing E160116 gateway PFD contour. The applicant for the E160116 gateway filed before July 14, 2016 and did not file a PFD contour.¹² As a result, Amazon uses the technical parameters from the E160116 gateway license to compute the -77.6 dBW/m²/MHz PFD contour.

Figure 3 shows the PFD contour for the existing E160116 gateway in Google Earth.

¹⁰ See Guidance at 3 (computing PFD contours and protection zones at bullet 3).

¹¹ See *id.* (computing PFD contours and protection zones at bullet 5).

¹² See 47 C.F.R. § 25.136(a)(3).

Figure 2. New Amazon Gateway PFD Contour

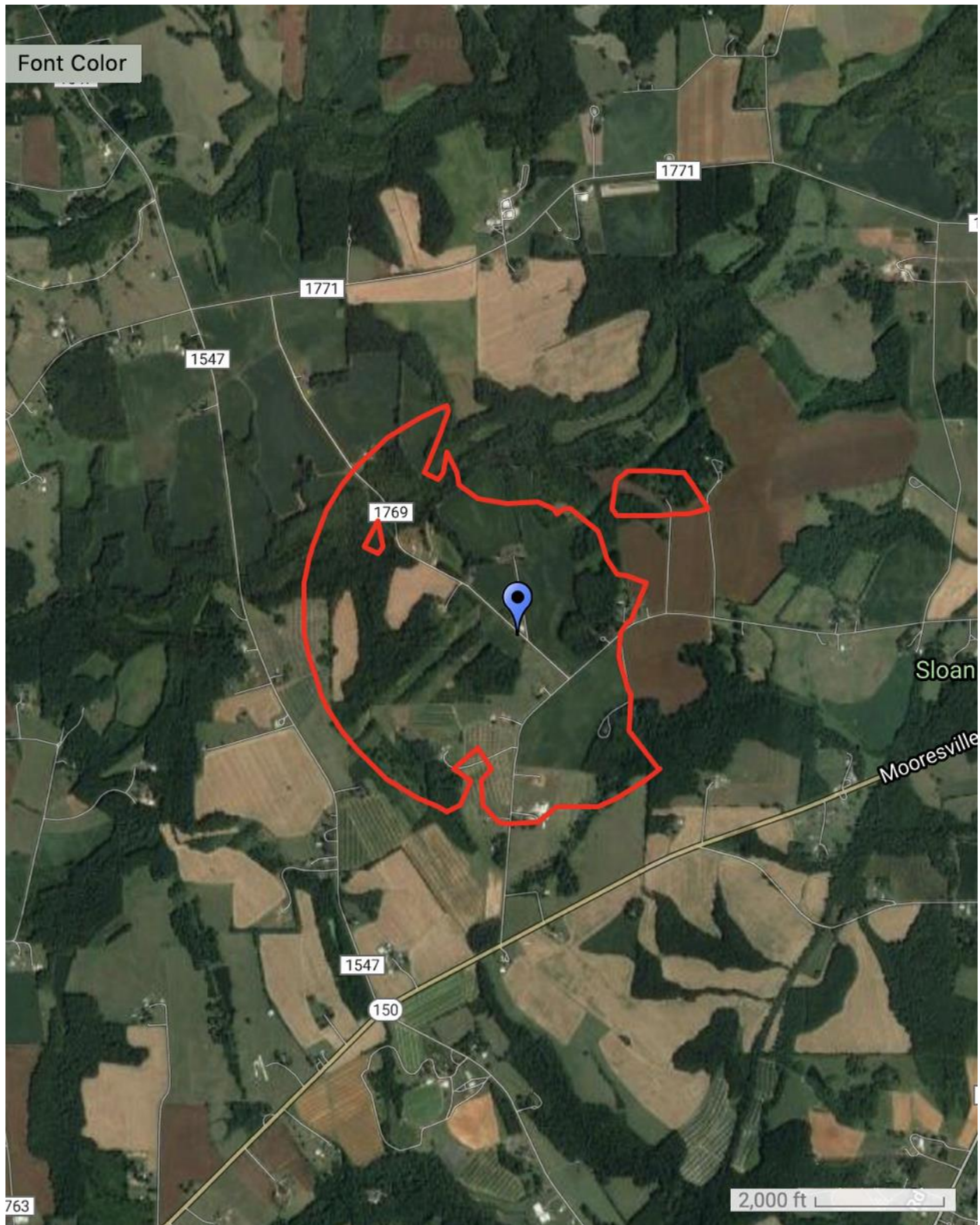
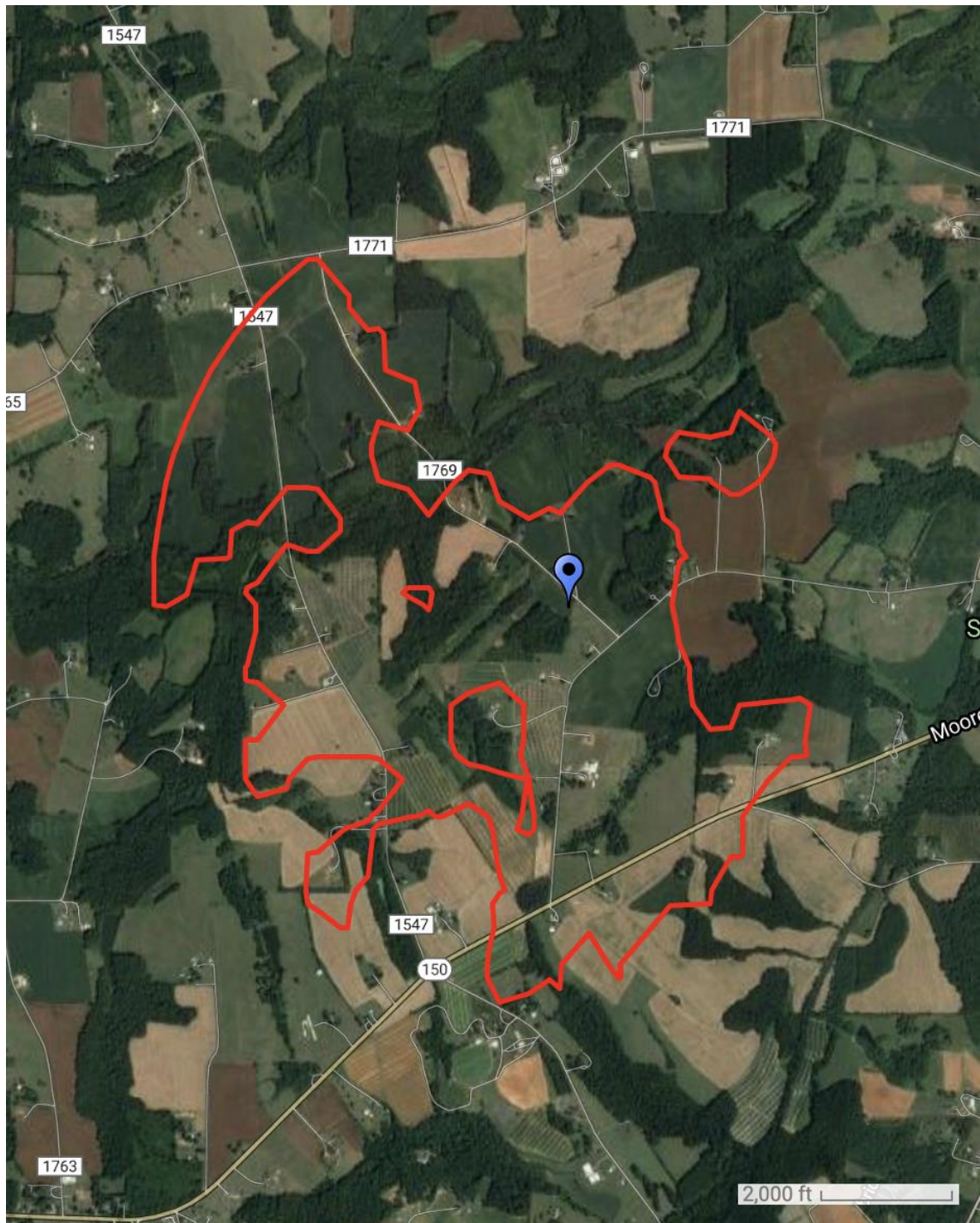
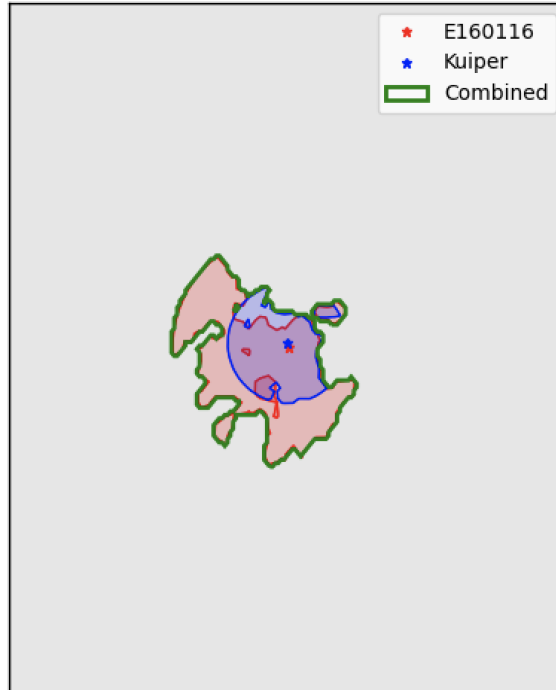


Figure 3. Existing E160116 Gateway PFD Contour



Aggregate PFD contour. Figure 4 shows the aggregate PFD contour (new Amazon gateway PFD contour and existing E160116 gateway PFD contour).

Figure 4. Aggregate PFD Contour



Section 25.136(a)(4)(ii) (-77.6 dBm/m²/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/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 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.

If the aggregate PFD contour falls outside the existing gateway PFD contour, only the population outside the existing gateway's PFD contour will count against the aggregate population limit for

that licensing area.¹³ Here, Amazon determined the overlap of the existing E160116 gateway PFD contour and new Amazon gateway PFD contour, as Figure 4 illustrates, and considered only the population covered by the new Amazon gateway PFD contour area outside the existing gateway's PFD contour when assessing compliance with the aggregate population limits.

The resulting PFD contour overlaps several census blocks, all in the County. The County's population totals 138,428 people, according to 2010 U.S. Census Bureau data,¹⁴ so the maximum population permitted within the FSS gateway's -77.6 dBW/m²/MHz PFD contour is 450 people.

New Amazon gateway. Figure 5 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. Amazon determined that the proposed gateway's PFD contour covers no more than 15 people¹⁵—less than the 450 limit—using 2010 U.S. Census Bureau data and the actual area method.¹⁶

Combined new Amazon gateway and E160116 gateway contour. Figure 6 shows the census blocks that are fully or partially covered by the aggregate PFD contour created by the new Amazon gateway and the E160116 gateway. Table 3 shows the total population, fractional area coverage, and fractional population coverage for each fully and partially covered census block. Table 4 shows the total population covered in each county that the aggregate PFD contour overlaps.

As demonstrated below, Amazon's gateway complies with the aggregate population coverage limits in Section 25.136(a)(4)(ii).

¹³ See Guidance at 5 (colocation of earth stations at bullet 3).

¹⁴ See *Rowan County, North Carolina*, U.S. Census Bureau, <https://bit.ly/3vTJBkJ> (last visited March 24, 2021).

¹⁵ A number of people covered by the new Amazon gateway PFD contour are covered by the existing E160116 PFD contour.

¹⁶ See Guidance at 4 (determining estimated aggregate population coverage at bullet 2).

Figure 5. Census Block and Population Coverage of New Amazon Gateway PFD Contour

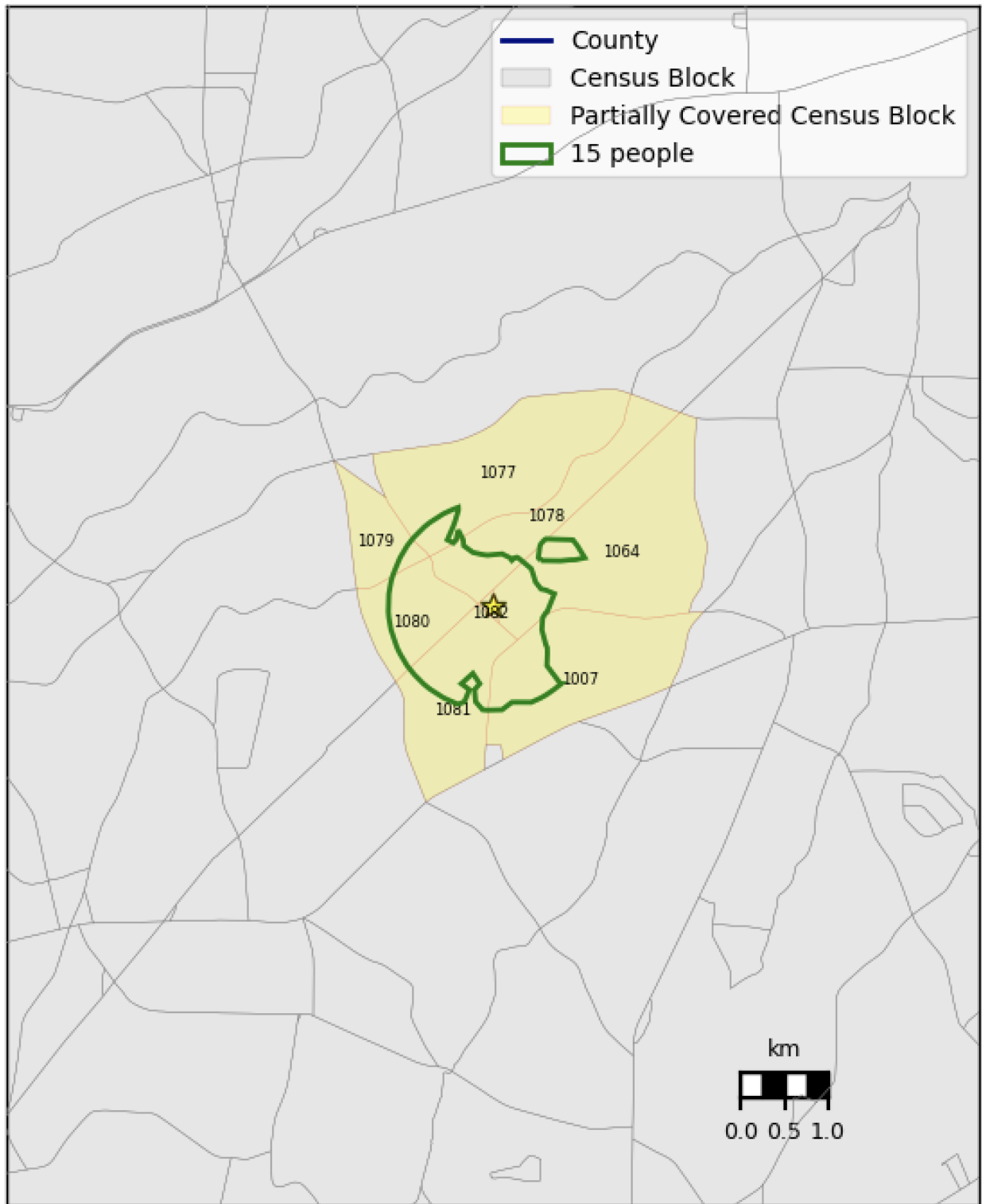


Table 1. New Amazon Gateway PFD Contour Population Coverage, by Census Block

State	County	Block ID	Block Population	Coverage Fraction	Covered Population
NC	Rowan	371590518021007	25	19%	4.8
NC	Rowan	371590519011064	21	14%	3.0
NC	Rowan	371590519011077	7	5%	0.4
NC	Rowan	371590519011078	3	27%	0.8
NC	Rowan	371590519011079	0	10%	0.0
NC	Rowan	371590519011080	0	71%	0.0
NC	Rowan	371590519011081	15	42%	6.3
NC	Rowan	371590519011082	0	100%	0.0

Table 2. New Amazon Gateway PFD Contour Population Coverage, by County

State	County	County Population	Allowable Population Coverage	Covered Population
NC	Rowan	138,428	450	15.3

Figure 6. Census Block and Population Coverage of Aggregate PFD Contour

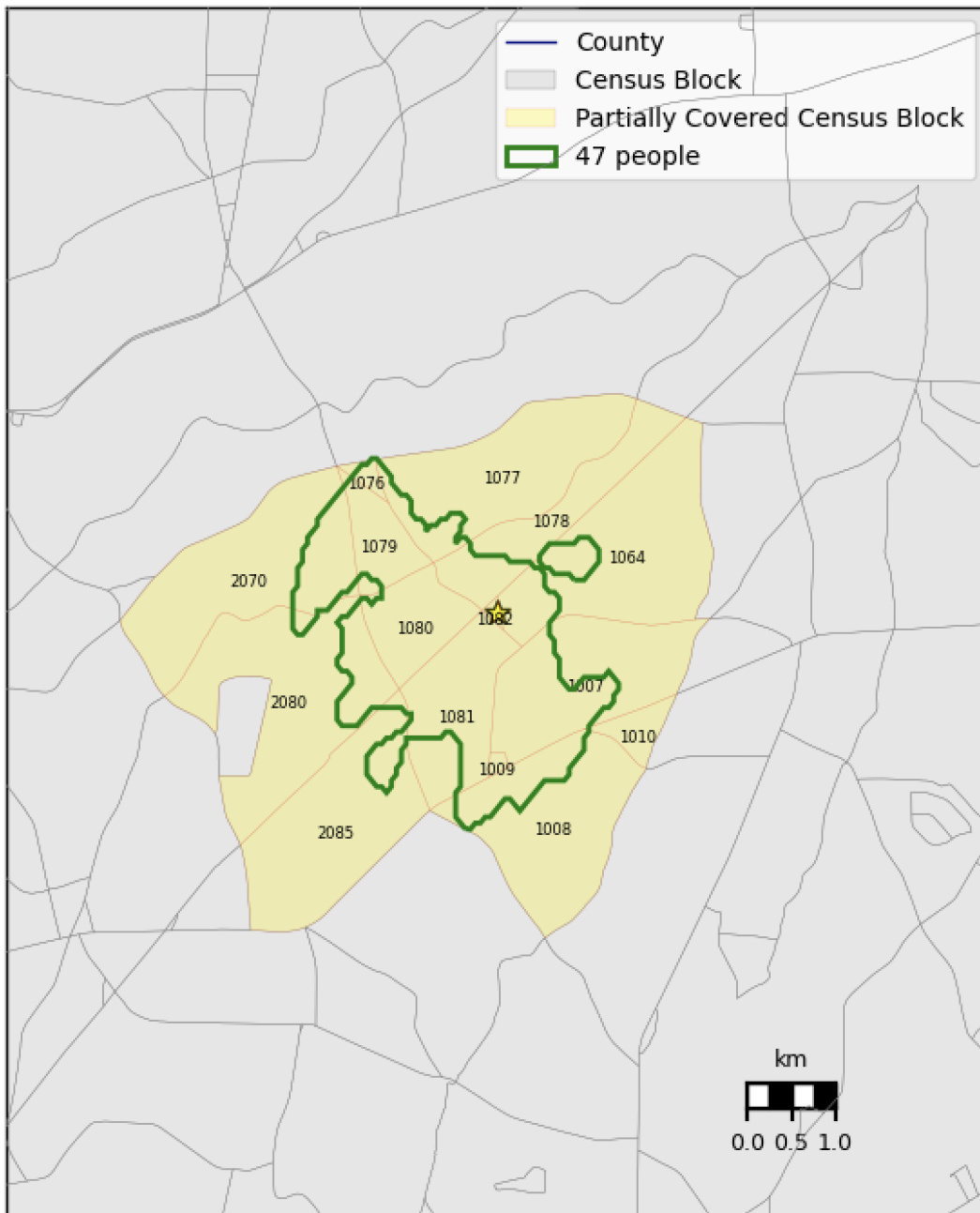


Table 3. Aggregate PFD Contour Population Coverage, by Census Block

State	County	Block ID	Block Population	Coverage Fraction	Covered Population
NC	Rowan	371590518021007	25	48%	12.1
NC	Rowan	371590518021008	15	21%	3.2
NC	Rowan	371590518021009	0	100%	0.0
NC	Rowan	371590518021010	27	0%	0.1
NC	Rowan	371590519011064	21	19%	3.9
NC	Rowan	371590519011076	0	75%	0.0
NC	Rowan	371590519011077	7	12%	0.9
NC	Rowan	371590519011078	3	29%	0.9
NC	Rowan	371590519011079	0	91%	0.0
NC	Rowan	371590519011080	0	99%	0.0
NC	Rowan	371590519011081	15	78%	11.7
NC	Rowan	371590519011082	0	100%	0.0
NC	Rowan	371590519012070	34	20%	6.8
NC	Rowan	371590519012080	35	17%	6.0
NC	Rowan	371590519012085	30	8%	2.3

Table 4. PFD Contour Population Coverage, by County

State	County	County Population	Allowable Population Coverage	Covered Population
NC	Rowan	138,428	450	47.8

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/m²/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/m²/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.

Amazon searched Google Earth and used visual analysis and shapefile data available on data.gov and the U.S. Census Bureau website to assess whether the Amazon gateway's -77.6 dBm/m²/MHz PFD contour contains any major event venues, urban mass transit route, passenger railroad, or cruise ship port. As indicated in Figure 7, the PFD contour does not overlap any such infrastructure. The PFD contour also 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.¹⁷ The proposed gateway, therefore, adheres to Section 25.136(a)(iii).

¹⁷ See *Planning, Environment, Realty (HEP) HEPGIS*, U.S. Department of Transportation Federal Highway Administration, <https://hepgis.fhwa.dot.gov/fhwagis/> (last visited March 24, 2021).

Figure 7. Amazon gateway 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/m²/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/m²/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.¹⁸

¹⁸ 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	$G_{ff(dBi)} = 29 - 25\log_{10}(\theta)$ $\theta = \text{min elevation} = 20^\circ$	
Far-Field Off-Axis Gain		0.89	$G_{ff} = 10^{\left(\frac{G_{ff(dBi)}}{10}\right)}$	
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.
MOUNT ULLA, NC
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.
B2x Online Inc
Bladen, County of
Buncombe County
Business Only Broadband, LLC
Capitol Broadcasting Company Inc - WRAL
Cellco Partnership - North Carolina
Cellco Partnership - South Carolina
City of Durham, NC
City of Greenville, SC
Clearwire Spectrum Holdings II, LLC
Clearwire Spectrum Holdings III, LLC
Clearwire Spectrum Holdings LLC
Conterra Ultra Broadband, LLC
EnergyUnited EMC
Florence City South Carolina
Franklin County Schools
General Dynamics - OTS, Inc.
Hardy Cellular Telephone Company
Liberty University
Moore County of
NTInet, Inc
New Cingular Wireless PCS LLC - VA
New Cingular Wireless PCS LLC - WV,NC,SC
North Carolina State Highway Patrol
Olympic Wireless, LLC
Orange Water and Sewer Authority
PTA-FLA, Inc.
Roanoke County of
SC Educational Television Commission
Shenandoah Personal Communications, LLC
South Carolina Dept of Transportation
Sprint Spectrum L.P.
Sprintcom, Inc
T-Mobile License LLC
Telecom Transport Management, Inc
The Wired Road Authority
USCOC of Greater North Carolina, LLC
Verizon Wireless (VAW) LLC- Tennessee
Virginia Everywhere, LLC

WCNC TV Inc.
WUNC Public Radio, LLC
Warren County Emergency Services
West Virginia Educational Broadcasting
York, County of
iHM Licenses, 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: 210202COMSGE03

Administrative Information

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

Site Information

MOUNT ULLA, NC

Venue Name:
Latitude (NAD 83): 35° 38' 58.2" N
Longitude (NAD 83): 80° 40' 5.3" W
Climate Zone: A
Rain Zone: 1
Ground Elevation (AMSL): 246.43 m / 808.5 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%
	Short Term	-146.0 dBW/MHz 0.01%
		-151.0 dBW/4 kHz 20%
		-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

MOUNT ULLA, NC

Licensee Name Kuiper Systems LLC.
Latitude (NAD 83) 35° 38' 58.2" N
Longitude (NAD 83) 80° 40' 5.3" W
Ground Elevation (AMSL) 246.43 m / 808.5 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)

Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Receive 18.0 GHz		Transmit 28.0 GHz	
			Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
0	0.00	95.47	-0.50	247.00	-0.50	25.00
5	0.00	90.47	-0.50	247.00	-0.50	25.00
10	0.00	85.47	-0.50	247.00	-0.50	25.00
15	0.00	80.47	-0.50	247.00	-0.50	25.00
20	0.00	75.48	-0.50	247.00	-0.50	25.00
25	0.00	70.48	-0.50	247.00	-0.50	25.00
30	0.00	65.48	-0.50	247.00	-0.50	25.00
35	0.00	60.48	-0.50	247.00	-0.50	25.00
40	0.00	55.48	-0.50	247.00	-0.50	25.00
45	0.00	50.48	-0.50	247.00	-0.50	25.00
50	0.00	45.48	-0.50	247.00	-0.50	25.00
55	0.00	40.49	-0.50	247.00	-0.50	25.00
60	0.00	35.49	-0.50	247.00	-0.50	25.00
65	0.00	30.49	-0.50	247.00	-0.50	25.00
70	0.00	25.50	-0.50	247.00	-0.50	25.00
75	0.00	20.50	-0.50	247.00	-0.50	25.00
80	0.00	15.51	-0.50	247.00	-0.50	25.00
85	0.00	10.53	-0.50	247.00	-0.50	25.00
90	0.00	5.59	-0.50	247.00	-0.50	25.00
95	0.00	1.22	-0.50	247.00	-0.50	25.00
100	0.00	4.66	-0.50	247.00	-0.50	25.00
105	0.00	9.59	-0.50	247.00	-0.50	25.00
110	0.00	14.57	-0.50	247.00	-0.50	25.00
115	0.00	19.56	-0.50	247.00	-0.50	25.00
120	0.00	24.55	-0.50	247.00	-0.50	25.00
125	0.00	29.55	-0.50	247.00	-0.50	25.00
130	0.00	34.54	-0.50	247.00	-0.50	25.00
135	0.00	39.54	-0.50	247.00	-0.50	25.00
140	0.00	44.54	-0.50	247.00	-0.50	25.00
145	0.00	49.54	-0.50	247.00	-0.50	25.00
150	0.00	54.53	-0.50	247.00	-0.50	25.00
155	0.00	59.53	-0.50	247.00	-0.50	25.00
160	0.00	64.53	-0.50	247.00	-0.50	25.00
165	0.00	69.53	-0.50	247.00	-0.50	25.00
170	0.00	74.53	-0.50	247.00	-0.50	25.00
175	0.00	79.53	-0.50	247.00	-0.50	25.00
180	0.00	84.53	-0.50	247.00	-0.50	25.00
185	0.00	89.53	-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

MOUNT ULLA, NC

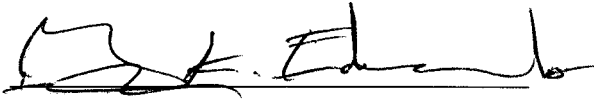
Licensee Name Kuiper Systems LLC.
Latitude (NAD 83) 35° 38' 58.2" N
Longitude (NAD 83) 80° 40' 5.3" W
Ground Elevation (AMSL) 246.43 m / 808.5 ft
Antenna Centerline (AGL) 2.74 m / 9.0 ft
Antenna Model Kuiper 2.4 meter
Antenna Mode Receive 18.0 GHz Transmit 28.0 GHz
Interference Objectives: Long Term -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)

Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Receive 18.0 GHz		Transmit 28.0 GHz	
			Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
190	0.00	94.53	-0.50	247.00	-0.50	25.00
195	0.00	99.53	-0.50	247.00	-0.50	25.00
200	0.00	104.52	-0.50	247.00	-0.50	25.00
205	0.00	109.52	-0.50	247.00	-0.50	25.00
210	0.23	114.52	-0.50	247.00	-0.50	25.00
215	0.22	119.52	-0.50	247.00	-0.50	25.00
220	0.00	124.52	-0.50	247.00	-0.50	25.00
225	0.00	129.52	-0.50	247.00	-0.50	25.00
230	0.00	134.52	-0.50	247.00	-0.50	25.00
235	0.00	139.51	-0.50	247.00	-0.50	25.00
240	0.00	144.51	-0.50	247.00	-0.50	25.00
245	0.00	149.51	-0.50	247.00	-0.50	25.00
250	0.00	154.50	-0.50	247.00	-0.50	25.00
255	0.00	159.50	-0.50	247.00	-0.50	25.00
260	0.00	164.49	-0.50	247.00	-0.50	25.00
265	0.00	169.47	-0.50	247.00	-0.50	25.00
270	0.00	174.41	-0.50	247.00	-0.50	25.00
275	0.00	178.78	-0.50	247.00	-0.50	25.00
280	0.00	175.34	-0.50	247.00	-0.50	25.00
285	0.00	170.41	-0.50	247.00	-0.50	25.00
290	0.00	165.43	-0.50	247.00	-0.50	25.00
295	0.00	160.44	-0.50	247.00	-0.50	25.00
300	0.00	155.45	-0.50	247.00	-0.50	25.00
305	0.00	150.45	-0.50	247.00	-0.50	25.00
310	0.00	145.46	-0.50	247.00	-0.50	25.00
315	0.00	140.46	-0.50	247.00	-0.50	25.00
320	0.00	135.46	-0.50	247.00	-0.50	25.00
325	0.00	130.46	-0.50	247.00	-0.50	25.00
330	0.00	125.47	-0.50	247.00	-0.50	25.00
335	0.00	120.47	-0.50	247.00	-0.50	25.00
340	0.00	115.47	-0.50	247.00	-0.50	25.00
345	0.00	110.47	-0.50	247.00	-0.50	25.00
350	0.00	105.47	-0.50	247.00	-0.50	25.00
355	0.00	100.47	-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 – Mount Ulla, NC

Frequency Coordination Report

28 GHz



Prepared on Behalf of
KUIPER SYSTEMS, LLC

March 9, 2021



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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 Mount Ulla, NC, which will transmit at 28 GHz¹. 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 9, 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 Mount Ulla, NC 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
AT&T	Statewide: NC
Frontier	Nationwide

A notification letter and datasheets for the Ka-Band earth station in Mount Ulla, NC 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
Verizon (also an LMDS Licensee)	Market Based

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

4. Earth Station Coordination Data

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

Job Number: 210202COMSGE03

Administrative Information

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

Site Information

MOUNT ULLA, NC

Venue Name
Latitude (NAD 83) 35° 38' 58.2" N
Longitude (NAD 83) 80° 40' 5.3" W
Climate Zone A
Rain Zone 1
Ground Elevation (AMSL) 246.43 m / 808.5 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) (dBW/MHz)	-41.0 -17.0
Maximum EIRP	(dBW/4 kHz) (dBW/MHz)	12.8 36.8
Interference Objectives:	Long Term Short Term	-156.0 dBW/MHz 20% -146.0 dBW/MHz 0.01%
		-151.0 dBW/4 kHz 20% -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	MOUNT ULLA, NC
Licensee Name	Kuiper Systems LLC.
Latitude (NAD 83)	35° 38' 58.2" N
Longitude (NAD 83)	80° 40' 5.3" W
Ground Elevation (AMSL)	246.43 m / 808.5 ft
Antenna Centerline (AGL)	2.74 m / 9.0 ft
Antenna Model	Kuiper 2.4 meter
Antenna Mode	Receive 18.0 GHz
Interference Objectives: Long Term	-156.0 dBW/MHz 20%
Short Term	-146.0 dBW/MHz 0.01%
	Transmit 28.0 GHz
	-151.0 dBW/4 kHz 20%
	-128.0 dBW/4 kHz

Max Available RF Power -41.0 (dBW/4 kHz)

Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Receive 18.0 GHz		Transmit 28.0 GHz	
			Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
0	0.00	95.47	-0.50	247.00	-0.50	25.00
5	0.00	90.47	-0.50	247.00	-0.50	25.00
10	0.00	85.47	-0.50	247.00	-0.50	25.00
15	0.00	80.47	-0.50	247.00	-0.50	25.00
20	0.00	75.48	-0.50	247.00	-0.50	25.00
25	0.00	70.48	-0.50	247.00	-0.50	25.00
30	0.00	65.48	-0.50	247.00	-0.50	25.00
35	0.00	60.48	-0.50	247.00	-0.50	25.00
40	0.00	55.48	-0.50	247.00	-0.50	25.00
45	0.00	50.48	-0.50	247.00	-0.50	25.00
50	0.00	45.48	-0.50	247.00	-0.50	25.00
55	0.00	40.49	-0.50	247.00	-0.50	25.00
60	0.00	35.49	-0.50	247.00	-0.50	25.00
65	0.00	30.49	-0.50	247.00	-0.50	25.00
70	0.00	25.50	-0.50	247.00	-0.50	25.00
75	0.00	20.50	-0.50	247.00	-0.50	25.00
80	0.00	15.51	-0.50	247.00	-0.50	25.00
85	0.00	10.53	-0.50	247.00	-0.50	25.00
90	0.00	5.59	-0.50	247.00	-0.50	25.00
95	0.00	1.22	-0.50	247.00	-0.50	25.00
100	0.00	4.66	-0.50	247.00	-0.50	25.00
105	0.00	9.59	-0.50	247.00	-0.50	25.00
110	0.00	14.57	-0.50	247.00	-0.50	25.00
115	0.00	19.56	-0.50	247.00	-0.50	25.00
120	0.00	24.55	-0.50	247.00	-0.50	25.00
125	0.00	29.55	-0.50	247.00	-0.50	25.00
130	0.00	34.54	-0.50	247.00	-0.50	25.00
135	0.00	39.54	-0.50	247.00	-0.50	25.00
140	0.00	44.54	-0.50	247.00	-0.50	25.00
145	0.00	49.54	-0.50	247.00	-0.50	25.00
150	0.00	54.53	-0.50	247.00	-0.50	25.00
155	0.00	59.53	-0.50	247.00	-0.50	25.00
160	0.00	64.53	-0.50	247.00	-0.50	25.00
165	0.00	69.53	-0.50	247.00	-0.50	25.00
170	0.00	74.53	-0.50	247.00	-0.50	25.00
175	0.00	79.53	-0.50	247.00	-0.50	25.00
180	0.00	84.53	-0.50	247.00	-0.50	25.00
185	0.00	89.53	-0.50	247.00	-0.50	25.00

Coordination Values	MOUNT ULLA, NC
Licensee Name	Kuiper Systems LLC.
Latitude (NAD 83)	35° 38' 58.2" N
Longitude (NAD 83)	80° 40' 5.3" W
Ground Elevation (AMSL)	246.43 m / 808.5 ft
Antenna Centerline (AGL)	2.74 m / 9.0 ft
Antenna Model	Kuiper 2.4 meter
Antenna Mode	Receive 18.0 GHz
Interference Objectives: Long Term	-156.0 dBW/MHz 20%
Short Term	-146.0 dBW/MHz 0.01%
0.0025%	Transmit 28.0 GHz
	-151.0 dBW/4 kHz 20%
	-128.0 dBW/4 kHz

Max Available RF Power -41.0 (dBW/4 kHz)

Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Receive 18.0 GHz		Transmit 28.0 GHz	
			Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
190	0.00	94.53	-0.50	247.00	-0.50	25.00
195	0.00	99.53	-0.50	247.00	-0.50	25.00
200	0.00	104.52	-0.50	247.00	-0.50	25.00
205	0.00	109.52	-0.50	247.00	-0.50	25.00
210	0.23	114.52	-0.50	247.00	-0.50	25.00
215	0.22	119.52	-0.50	247.00	-0.50	25.00
220	0.00	124.52	-0.50	247.00	-0.50	25.00
225	0.00	129.52	-0.50	247.00	-0.50	25.00
230	0.00	134.52	-0.50	247.00	-0.50	25.00
235	0.00	139.51	-0.50	247.00	-0.50	25.00
240	0.00	144.51	-0.50	247.00	-0.50	25.00
245	0.00	149.51	-0.50	247.00	-0.50	25.00
250	0.00	154.50	-0.50	247.00	-0.50	25.00
255	0.00	159.50	-0.50	247.00	-0.50	25.00
260	0.00	164.49	-0.50	247.00	-0.50	25.00
265	0.00	169.47	-0.50	247.00	-0.50	25.00
270	0.00	174.41	-0.50	247.00	-0.50	25.00
275	0.00	178.78	-0.50	247.00	-0.50	25.00
280	0.00	175.34	-0.50	247.00	-0.50	25.00
285	0.00	170.41	-0.50	247.00	-0.50	25.00
290	0.00	165.43	-0.50	247.00	-0.50	25.00
295	0.00	160.44	-0.50	247.00	-0.50	25.00
300	0.00	155.45	-0.50	247.00	-0.50	25.00
305	0.00	150.45	-0.50	247.00	-0.50	25.00
310	0.00	145.46	-0.50	247.00	-0.50	25.00
315	0.00	140.46	-0.50	247.00	-0.50	25.00
320	0.00	135.46	-0.50	247.00	-0.50	25.00
325	0.00	130.46	-0.50	247.00	-0.50	25.00
330	0.00	125.47	-0.50	247.00	-0.50	25.00
335	0.00	120.47	-0.50	247.00	-0.50	25.00
340	0.00	115.47	-0.50	247.00	-0.50	25.00
345	0.00	110.47	-0.50	247.00	-0.50	25.00
350	0.00	105.47	-0.50	247.00	-0.50	25.00
355	0.00	100.47	-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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Email:	DJimeno@Comsearch.com
Web site:	www.comsearch.com

EXHIBIT D (ANTENNA PATTERN)

2.4m Antenna Pattern
Frequency: 27500 MHz (CoPol)
Gain: 53.8 dBi

