

Kuiper Systems LLC
Application for Special Temporary Authority
Narrative Statement

Pursuant to Sections 5.51, 5.54(a)(2), and 5.61 of the rules¹ of the Federal Communications Commission (“Commission”), Kuiper Systems LLC, a wholly owned subsidiary of Amazon.com Services LLC (“Amazon.com” or “Amazon”), hereby respectfully requests special temporary authority for an experimental license to operate in the 18.3-18.6, 18.8-19.3, and 19.7-20.2 GHz (downlink) and 28.6-29.1 GHz (uplink) band segments for a period of six months to conduct testing of prototype antennas. In support of its request, Amazon provides the following additional information required by Section 5.61:

(1) Name, address, phone number (also email address and facsimile number, if available) of the applicant.

*Amazon Stop Buzzer
Contact*

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(2) Explanation of why an STA is needed.

Amazon seeks special temporary authority for a series of tests to evaluate the functionality and performance of prototype earth station and spacecraft antennas by operating on-site over-the-air test stations comprised of a combination of commercial off-the-shelf equipment and the equipment under test. Amazon seeks to commence testing as soon as possible, by June 5, 2021, to allow it to evaluate prototype equipment in furtherance of developing innovative satellite-delivered services to customers. Accordingly, grant of the requested experimental authority would serve the public interest, convenience, and necessity.

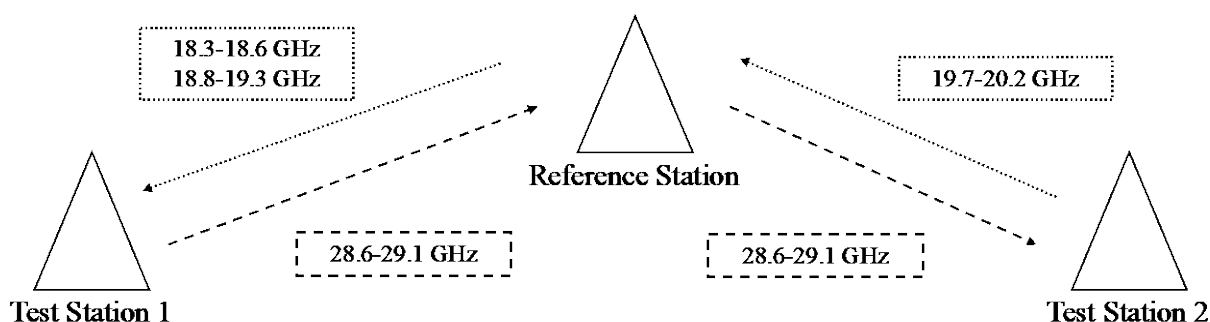
(3) Description of the operation to be conducted and its purpose.

Amazon proposes to conduct over-the-air outdoor tests of a prototype earth station antenna (“Antenna 1”) and a prototype spacecraft antenna (“Antenna 2”) to evaluate the wireless communication capabilities of such equipment. To perform these tests, Amazon will operate three distinct transmitting stations:

¹ 47 C.F.R. §§ 5.51, 5.54(a)(2), 5.61.

- The first station (“Test Station 1”) is comprised of the Antenna 1 prototype and commercial off the shelf transmitter equipment
- The second station (“Test Station 2”) is comprised of the Antenna 2 prototype and commercial off the shelf transmitter equipment
- A third station (“Reference Station”) is comprised of one of several possible commercial off the shelf antennas and transmitter equipment

As indicated in the diagram below, Amazon’s testing will involve bi-directional transmissions and signal receptions between Test Station 1 and the Reference Station, as well as Test Station 2 and the Reference Station. During active test events, these respective bi-directional links may be operated in a half-duplex or full-duplex configuration. However, the Reference Station will only maintain one bi-directional link between one test station at any point in time.²



All stations and antennas will be operated only at ground level; no operations will occur at altitude. All experimental operations will take place outdoors within the premises of the test location defined over the following rectangular geographic polygon coordinates:

47°42'43.92"N; 122° 7'53.40"W	47°42'43.92"N; 122° 7'38.28"W
47°42'40.68"N; 122° 7'53.40"W	47°42'40.68"N; 122° 7'38.28"W

(4) Time and dates of proposed operation.

Amazon requests special temporary authority for a 180-day period and seeks to commence testing June 5, 2021. On the days of testing, the prototype earth station, prototype spacecraft antenna and test station will operate sporadically in 15-20 minute increments during the day and will not continuously transmit.

(5) Class(es) of station (e.g., fixed, mobile, or both) and call sign of station (if applicable).

² Amazon will operate Test Station 1 and Test Station 2, respectively, in isolation from the other. This means that only one of these stations will be operated during an active test event. The Reference Station may be operated when testing either prototype, but the frequencies over which the Reference Station may transmit will be limited to band(s) specific to the prototype under test as indicated in the diagram.

Mobile stations will be used; there are no call signs associated with any of the stations.

(6) Description of the location(s) and, if applicable, geographical coordinates of the proposed operation.

Amazon proposes to operate on privately-owned land located in King County in Washington State, within the coordinates specified in item (3), above.

Amazon recognizes that experimental operations must not cause harmful interference to authorized facilities, and, prior to commencing operations, Amazon will coordinate with any incumbent licensees as needed to ensure that Amazon's operations do not interfere with authorized operations. A preliminary search has determined that there are no terrestrial microwave licensees or secondary systems operating in the requested frequencies in the vicinity of the testing location. The operational characteristics of the testing (for example, its sporadic transmission over 15-20 minutes intervals) greatly reduce the likelihood that Amazon's operations will cause harmful interference to any licensees.³ However, should interference occur, Amazon will take immediate steps to resolve the interference, including by discontinuing operations if necessary. In furtherance of this commitment, Amazon provides a stop buzzer point of contact in item (1), above.

(7) Equipment to be used, including name of manufacturer, model and number of units.

Reference Station Antennas:

Manufacturer	Model Number	Number of units
Eravant	SAC-1533-470-S2	1
Eravant	SAF-2633331725-315-S1	1
Eravant	SAO-2734030345-28-S1	1
Eravant	SAP-28-R2	1

Test Station 1 Antennas:

Manufacturer	Model Number	Number of units
Amazon	Prototype earth station antenna (Antenna 1)	1

Test Station 2 Antennas:

Manufacturer	Model Number	Number of units
Amazon	Prototype spacecraft antenna (Antenna 2)	1

³ A review of the Commission's ULS database confirms that there are no terrestrial services operating in the 28.6-29.1 GHz band. The Commission's IBFS database indicates that the closest earth station that utilizes the 18.3-18.6, 18.8-19.3 and 19.7-20.2 GHz bands is approximately 16 miles away.

Transmitters:

Manufacturer	Model Number	Number of units
SAF Tehnika	J0SSAG13	1
Rohde & Schwarz	SMA100B	1
SAF Tehnika	J0SSAG14	1

Amplifiers:

Manufacturer	Model Number	Number of units
RF-Lambda	RFLUPA27G32GN	1
RF-Lambda	RFLUPA20G47GA	1

(8) Frequency (or frequency bands) requested.

The requested frequency bands are summarized in the table directly below. See the diagram in item (3) for a visualization on inter-station connectivity with specific band usage.

Transmitting Station	Frequency Band(s)
Reference Station	18.3-18.6, 18.8-19.3, and 28.6-29.1 GHz
Test Station 1	28.6-29.1 GHz
Test Station 2	19.7-20.2 GHz

(9) Minimum and maximum effective radiated power (ERP) or equivalent isotropically radiated power (EIRP).**Reference Station⁴:**

Frequency Band(s)	Antenna	Minimum ERP (mW)	Minimum ERP (dBW)	Maximum ERP (W)	Maximum ERP (dBW)
18.3-18.6 and 18.8-19.3	SAC-1533-470-S2 (Directional)	9.66	-20.15	1.22	0.85
28.6-29.1 GHz	SAF-2633331725-315-S1 (Directional)	0.61	-32.15	121.62	20.85
28.6-29.1 GHz	SAO-2734030345-28-S1 (Omni)	15.31	-18.15	3054.92	34.85
28.6-29.1 GHz	SAP-28-R2 (Directional)	1.36	-28.65	272.27	24.35

⁴ In the 28.6-29.1 GHz band, the Reference Station may transmit using one of three applicable antennas (as listed in the table), however only one of these antennas will be radiating at any point in time.

Test Station 1:

Frequency Band(s)	Antenna	ERP (W)	ERP (dBW)
28.6-29.1 GHz	Prototype earth station antenna (Antenna 1)	2162.7	33.4

Test Station 2:

Frequency Band(s)	Antenna	ERP (W)	ERP (dBW)
19.7-20.2 GHz	Prototype spacecraft antenna (Antenna 2)	1109.2	30.5

(10) Emission designator or describe emission (bandwidth, modulation, etc.).**Reference Station:**

Frequency Band(s)	Emission Type/Designator	Frequency Stability
18.3-18.6, 18.8-19.3, and 28.6-29.1 GHz	Continuous wave (N0N)	10 ppm

Test Station 1:

Frequency Band(s)	Emission Type/Designator	Frequency Stability
28.6-29.1 GHz	Continuous wave (N0N), 16M7D1W, 16M7D7W, 100MD1W, 100MD7W	10 ppm

Test Station 2:

Frequency Band(s)	Emission Type/Designator	Frequency Stability
19.7-20.2 GHz	Continuous wave (N0N), 500MD1W, 500MD7W	10 ppm

(11) Overall height of antenna structure above the ground.

The height of Antenna 1 and Antenna 2 will be 1.2 approximately meters above ground. The height of the reference station antennas will range between 1.0-3.0 meters above ground.

In addition to the above, Amazon provides the following information, which also appears on the application form:

(12) Width of the beam in degrees at the half power point.**Reference Station:**

Antenna	Beam Width (degrees)
SAC-1533-470-S2 (Directional)	30° E-Plane, 36° H-Plane
SAO-2734030345-KF-S1 (Omni)	45° E-Plane
SAF-2633331725-315-S1 (Directional)	25° E-Plane, 25° H-Plane
SAP-28-R2 (Directional)	115° E-Plane, 60° H-Plane

Test Station 1:

Antenna	Beam Width (degrees)
Prototype earth station antenna (Antenna 1)	3.6°

Test Station 2:

Antenna	Beam Width (degrees)
Prototype spacecraft antenna (Antenna 2)	2.45°

(13) Orientation in horizontal plane (degrees).

All antennas listed in this application may operate at any azimuth angle with respect to the horizontal plane (0°-360°)

(14) Orientation in vertical plane (degrees).

Reference Station:

Antenna	Vertical Range of Boresight Operation
SAC-1533-470-S2 (Directional)	0°-90° (Horizon to nadir)
SAO-2734030345-KF-S1 (Omni)	90° (Horizon)
SAF-2633331725-315-S1 (Directional)	0°-90° (Horizon to nadir)
SAP-28-R2 (Directional)	0°-90° (Horizon to nadir)

Test Station 1:

Antenna	Vertical Range of Boresight Operation
Prototype earth station antenna (Antenna 1)	(-90°)-30° (Nadir to Maximum elevation above horizon)

Test Station 2:

Antenna	Vertical Range of Boresight Operation
Prototype spacecraft antenna (Antenna 2)	(-90°)-30° (Nadir to Maximum elevation above horizon)

(15) RF exposure compliance

The Commission's rules for radiofrequency (RF) exposure "reflect the best available information concerning safe levels of RF exposure for workers and members of the general public" and "specify methods that RF equipment operators can use to mitigate the risk of excess exposure."⁵ Amazon will comply with these RF exposure guidelines with respect to the prototype antennas and test station transmissions, for uncontrolled (general population) and controlled (occupational) environments, as specified by Section 1.1310 of the Commission's rules. The testing will occur on private land, with restricted access only to authorized personnel. Hence, any transmissions will not occur in proximity to the general population. All Amazon personnel operating and maintaining the equipment will be trained on proper handling of the equipment to mitigate radiofrequency exposure. Furthermore, all transmissions will be positively controlled by Amazon personnel during testing who will be able to cease transmissions at any time.

⁵ *Proposed Changes in the Commission's Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields*, 34 FCC Rcd 11687, paras. 2-3 (2019).