Exhibit A
Spire Global, Inc.
Response to Question 43
FCC Form 312

Description of Application

Spire Global, Inc. ("Spire") hereby requests authority to operate the earth stations identified in Attachment 1 to this exhibit[1] as part of the ground segment for the LEMUR satellite system.[2] The LEMUR system will provide maritime monitoring, aircraft monitoring, and meteorological monitoring.[3] Spire requests authority to use the 402-403 MHz band for uplink and telemetry, tracking, and command ("TT&C"),[4] the 449.75-450.25 MHz band for TT&C, and the 2020-2025 MHz band for downlink.[5] Spire has requested additional frequencies for its Phase II LEMUR satellites.[6] However, Spire will be amending its request to use those frequencies in the next couple of months, so it does not seek authority to use those frequencies with the proposed earth stations at this time.[7]

[1] Spire is contemporaneously submitting separate applications for its ground stations. Except for location-specific information, including the number and height of the antennas, the applications are materially the same. *See* Attachment 1.
[2] *See* Application of Spire Global, Inc., File No. SAT-LOA-20151123-00078 (filed Nov. 23, 2015) ("LEMUR Phase IA Application"); Amendment Application of Spire Global, Inc., File No. SAT-AMD-20161114-00107 (filed Nov. 14, 2016) ("LEMUR Phase IB/IC Application"). Spire also plans to deploy unlicensed receive-only facilities— on a non-harmful interference and unprotected basis—as part of its ground system. *See* 47 C.F.R. § 25.131; *Regulation of Domestic Receive-Only Satellite Earth Stations*, First Report and Order, 74 FCC 2d 205 ¶ 31 (1979); *see also Amendment of Part 25 of the Commission's Rules and Regulations to Reduce Alien Carrier Interference Between Fixed–Satellites at Reduced Orbital Spacings and to Revise Application Processing Procedures for Satellite Communications Services*, First Report and Order, 6 FCC Rcd 2806 (1991).
[3] *See* LEMUR Phase IA Application, Exhibit A at 7; LEMUR Phase IB/IC Application, Exhibit A at 3.
[4] The 402-403 MHz band will also be used for backup downlink. *See* LEMUR Phase IA Application, Exhibit A at 1; LEMUR Phase IB/IC Application, Exhibit A at 5-6.
[5] *See* Attachment 3.
[6] The Phase II satellites will use the 8025-8400 MHz band for downlink, including TT&C, and the 2025-2110 MHz band for uplink, including TT&C. *See* LEMUR Phase IA Application, Exhibit A at 1-2.
[7] Spire will modify its licenses accordingly prior to the deployment of the Phase II satellites.

Consistent with the LEMUR Phase IA Application and LEMUR Phase IB/IC Application and to the extent necessary,[8] Spire requests waiver of the rules listed below and submits that good cause exists for grant of the requested waivers.[9]

Spire requests waiver of the U.S. Table of Frequency Allocations to use the 402-403 MHz band on a non-conforming, non-harmful interference basis.[10] The 402-403 MHz band is allocated to a number of satellite services, including earth exploration-satellite service ("EESS") (Earth-to-space), meteorological-satellite service ("METS") (Earth-to-space), and Meteorological Aids Service (radiosonde).[11] Spire's use of the band for its LEMUR satellites will be of limited duration.[12] The wide beamwidth of the low-band frequencies can greatly facilitate the reestablishment of a lost communications link. In any event, there is unlikely to be harmful interference because of the infrequent nature and type of transmissions from the satellite

[8] *See* LEMUR Phase IA Application, Exhibit A at 23-24; LEMUR Phase IB/IC Application, Exhibit A at 12-23.
[9] *See* 47 C.F.R. § 1.3; *see also WAIT Radio v. FCC*, 418 F.2d 1153 (D.C. Cir. 1969), cert. denied 409 U.S. 1027 (1972); *Northeast Cellular Tel. Co. v. FCC*, 897 F.2d 1166 (D.C. Cir. 1990).
[10] *See* 47 C.F.R. §§ 2.102(a), 2.106. As a companion to Section 2.106, Spire also seeks waiver of 47 C.F.R. § 2.102(a). As the Commission recently stated, waiver of Section 2.102(a) is necessary to authorize the requested operations that are not in conformance with the U.S. Table of Frequency Allocations. *See Iridium Constellation LLC Application for Modification of License to Authorize a Second-Generation NGSO MSS Constellation*, Order and Authorization, 31 FCC Rcd 8675 ¶ 21 n.77 (IB and OET 2016) (granting on its own motion waiver of Section 2.102(a) to permit Iridium Constellation LLC's proposed MSS (Earth-to-space) use of very high frequency bands in which there is no MSS allocation for the relevant use (domestic or international)). For convenience, all subsequent references to requests for waiver of the U.S. Table of Frequency Allocations refer to both Sections 2.102(a) and 2.106 of the Federal Communication Commission's ("Commission's") rules. *See also* LEMUR Phase IA Application, Exhibit A at 23; LEMUR Phase IB/IC Application, Exhibit A at 15-16.
[11] *See* 47 C.F.R. § 2.106; *see also id.* at nn. US64(a), US70, US384. The mobile service, excluding aeronautical mobile, is allocated to the Medical Device Radiocommunication Service operations on a secondary basis. *Id.* at n. US64(a). The Meteorological Aids Service can operate associated ground transmitters. *Id.* at n. US70. Finally, non-Federal EESS (Earth-to-Space) and METS (Earth-to-Space) are permitted to transmit only to Federal space stations. *Id.* at n. US384.
[12] *See* LEMUR Phase IA Application, Exhibit A at 9-10. The antenna will transmit only on one carrier frequency at a time.

system.[13] To the extent possible, Spire will coordinate with other operators in this band to ensure there is no harmful interference. Per conditions imposed through Spire's Phase IB/IC space station license grants,[14] Spire is required to coordinate and receive approval from Department of Commerce/National Oceanic and Atmospheric Administration ("DOC/NOAA") to operate all new potential 402-403 MHz stations. As shown in Attachment 4, Spire has received DOC/NOAA approval to operate 402-403 MHz stations at the locations listed in Attachment 1.

Spire requests waiver of the U.S. Table of Frequency Allocations to use the 449.75-450.25 MHz on a non-conforming, non-harmful interference basis.[15] Footnotes 5.286 and US87 state that this band may be used for Space Operations Service (Earth-to-space), subject to agreement obtained under No. 9.21.[16] Spire has filed its coordination request with the Commission, which has in turn filed the request with the International Telecommunication Union. Spire requests to use this band on a non-conforming, non-harmful interference basis until Spire has reached all necessary coordination agreements with other administrations. To the extent possible, Spire will coordinate with other operators in this band to ensure there is no harmful interference.

Spire also requests waiver of the U.S. Table of Frequency Allocations to use the 2020-2025 MHz band (space-to-Earth) on a non-conforming, non-harmful interference basis.[17]

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[13] *See id.* at 23.
[14] *See* Stamp Grant, Spire Global, Inc., IBFS File No. SAT-AMD-20161114-00107 (granted in part and deferred in part Apr. 7, 2017); Stamp Grant, Spire Global, Inc., IBFS File No. SAT-AMD-20161114-00107 (granted in part and deferred in part May 18, 2017); Stamp Grant, Spire Global, Inc., IBFS File No. SAT-AMD-20161114- 00107 (granted in part and deferred in part July 13, 2017).
[15] *See* 47 C.F.R. §§ 2.102(a), 2.106; *see also* LEMUR Phase IB/IC Application, Exhibit A at 23.
[16] *See* 47 C.F.R. § 2.106 nn. 5.286, US87.
[17] *See* 47 C.F.R. §§ 2.102(a), 2.106; *see also* LEMUR Phase IA Application, Exhibit A at 24; LEMUR Phase IB/IC Application, Exhibit A at 13.

Although there is a co-primary mobile-satellite service allocation in the 2020-2025 MHz band for ITU Region 2, the frequency band is allocated only for fixed and mobile service in the U.S.[18] Spire has been using this band since September 2015 in three countries, including the U.S., without reports of interference. Spire's use of this fallow band on an interim basis as it designs, builds, tests, and coordinates downlinks in 8025-8400 MHz in Phase II is an efficient use of spectrum and serves the public interest.[19]

[18] *See Amendment of the Commission's Rules with Regard to Commercial Operations in the 1695-1710 MHz, 1755-1780 MHz, and 2155-2180 MHz Bands*, Report and Order, 29 FCC Rcd 4610 ¶ 59 (2014).
[19] *See* LEMUR Phase IA Application, Exhibit A at 9-10; LEMUR Phase IB/IC Application, Exhibit A at 13.

Attachment 1
Earth Station Sites Characteristics

Modification of Existing Licenses

Station Name	Call Sign	File No.	Site Address	Latitude	Longitude	New Antenna at Location
GUMGS	E160038	SES-LIC-20160317-00252	312 Route 2A Shell Fuel Farm Road Piti, Guam 96925	13°24'56.3"N	144°41'15.1"E	UHF-3
ITOGS	E160037	SES-AMD-20160331-00301	93-1704 South Point Road Naalehu, HI 96772	19°0'50.90"N	155°39'46.78"W	UHF-3
SLCGS	E160042	SES-LIC-20160317-00256	7202 South Campus View Drive West Jordan, UT 84084	40°37'12.47"N	111°59'9.98"W	UHF-3

These three stations will maintain the UHF-1 and SBAND-1 antennas currently authorized for operations.
No Federal Aviation Administration notification is required for any of the proposed ground stations. 47 C.F.R. § 17.7(e).

Key –

- 402-403 MHz antennas
  - M2 Antenna Systems 401CP14 (“UHF-1”)
  - Innov 405-18-R (“UHF-2”)
- 449.75-450.25 MHz antenna
  - TACO H-105 (“UHF-3”)
- 2020-2025 MHz antennas
  - ARA – Seavey C1502-800 (“SBAND-1”)
  - Elite 999001 (“SBAND-2”)

New License Request

Station Name	Site Address	Latitude	Longitude	New Antennas at Location
CLTGS	5821 Fairview Road Suite G12/18 Charlotte, NC 28209	35°9'8.28"N	80°50'29.62"W	UHF-1; UHF-3; SBAND-1
DLHGS	3401 Technology Drive Duluth, MN 55811	46°49'39.38"N	92°07'49.82"W	UHF-2; UHF-3; SBAND-1
JNUGS2	1050 Harbor Way Juneau, AK 99824	58°18'06.69"N	134°25'35.06"W	UHF-1; SBAND1
TUSGS	1215 E Pennsylvania Street Tucson, AZ 85714	32° 10' 20.28"N	110° 57'14.94"W	UHF-2; SBAND-2

No Federal Aviation Administration notification is required for any of the proposed ground stations. 47 C.F.R. § 17.7(e).

Key –

- 402-403 MHz antennas
  - M2 Antenna Systems 401CP14 (“UHF-1”)
  - Innov 405-18-R (“UHF-2”)
- 449.75-450.25 MHz antenna
  - TACO H-105 (“UHF-3”)
- 2020-2025 MHz antennas
  - ARA – Seavey C1502-800 (“SBAND-1”)
  - Elite 999001 (“SBAND-2”)

Attachment 2
Additional Antenna Information

Due to the limitations of the Commission's Form 312 Schedule B form, Spire clarifies in this attachment some of its responses in that form. Spire will use the following antennas at the various ground stations identified in Attachment 1:

- Yagi antenna for its transmissions and reception of downlink transmissions in the 402-403 MHz band ("UHF-1" antenna or "UHF-2" antenna);
- Helical antenna for its transmissions in the 449.75-450.25 MHz band ("UHF-3" antenna); and
- Dual Circular Dish antenna for its reception of downlink transmissions in the 2020-2025 MHz band ("SBAND-1" antenna or "SBAND-2" antenna).

The characteristics of the five antennas are provided below.

Table 1: UHF-1 Yagi Antenna Characteristics

Manufacturer & Model	Antenna Length (m)	3dB Beamwidth (deg)	Polarization
M2 Antenna Systems 401CP14	1.85 x 0.38 x 0.38	60	RHCP

Table 2: UHF-2 Yagi Antenna Characteristics

Manufacturer & Model	Antenna Length (m)	3dB Beamwidth (deg)	Polarization
Innov 405-18-R	1.85 x 0.38 x 0.38	45.8	RHCP

Table 3: UHF-3 Helical Antenna Characteristics

Manufacturer & Model	Antenna Length (m)	3dB Beamwidth (deg)	Polarization
TACO H-105	2.46 x 0.23 x 0.23	35	RHCP

Table 4: SBAND-1 Dual Circular Dish Antenna Characteristics

Manufacturer & Model	Antenna Diameter (m)	3dB Beamwidth (deg)	Polarization
ARA – Seavey C1502-800	1.2	6.5	RHCP

Table 5: SBAND-2 Dual Circular Dish Antenna Characteristics

Manufacturer & Model	Antenna Diameter (m)	3dB Beamwidth (deg)	Polarization
Elite 999001	1.8	5.5	RHCP

Attachment 3
Frequency Bands

Frequency	Use
402-403 MHz (Earth-to-space)	Primary TT&C uplink
402-403 MHz (space-to-Earth)	Primary TT&C downlink Backup data downlink
449.75-450.25 MHz (Earth-to-space)	Primary TT&C uplink
2020-2025 MHz (space-to-Earth)	Primary data downlink

Attachment 4
DOC/NOAA Approval of New 402-403 MHz Ground Stations

spire

George John [redacted]

Spire - Coordination of UHF Ground Stations

David Franc [redacted] Mon, Jun 26, 2017 at 10:43 AM
To: George John [redacted]
Cc: Brandon Mitchell [redacted]

George,

We agree to the changes and additional stations, provided operations is still on an non interference basis (NIB).

Dave Franc

On Fri, Jun 23, 2017 at 10:37 AM, George John [redacted] wrote:

> Dave, Fred, Kellen -
>
> Happy Friday! Per condition 8 of our newest FCC license (attached), we are required to coordinate and receive approval from DOC/NOAA to operate all new potential UHF stations. We have previously sent our ground station list of where we would like to operate these new stations but have not heard back. So, below I have pasted our proposed new UHF sites for Spire.
>
> Please advise if you need any additional information to complete coordination. Your consideration is greatly appreciated.
>
> Kind regards,
> George
>
> **George John**
> Legal & Regulatory Counsel
> **Spire Global, Inc.**
> 575 Florida Street, Suite 150
> San Francisco, CA 94110 USA
> (202) 747-2619
> ---
>
> **New stations (outside of US)**

SupremeSAT Teleport Kandy, Sri Lanka	7°16'29.01" N	80°43'30.17" E
National Space Centre Cork, Ireland	51°57'11.20" N	08°10'30.29" W

> **New stations (inside of US)**

Involta 3401 Technology Drive Duluth, MN 55811	46°49'39.38" N	92°07'49.82" W
Charlotte Colocation Company 5821 Fairview Road SuiteG12/18 Charlotte, NC 28209	35°9'8.28" N	80°50'29.62" W
Involta 1215 E Pennsylvania Street Tucson, AZ 85714	32° 10' 20.28"N	110° 57' 14.94" W

> **Move stations (inside of US)**
>
> We are already authorized to use a Juneau station for UHF operations; however, we would look to move the station to a new location 8-10 miles away for easier access and maintenance capabilities. It's not a new station; we would just like to slightly move locations within Juneau.

[redacted]

New location

MXAK 1050 Harbor Way Juneau AK 99824	58°18'06.69" N	134°25'35.06" W

Old location

58.364028 N, 134.606444 W	58°21'50.65"N	134°36'21.52"W

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David Franc
Deputy Director for International Spectrum Activity

Department of Commerce,
Office of Radio Frequency Management

National Oceanic and Atmospheric Administration
1315 East-West Highway, Room 10601
Silver Spring, MD 20910-3282

[redacted]