Exhibit A - Narrative Statement

Introduction

Swarm Technologies Inc ("Swarm") is a California-based corporation seeking to deploy two communications satellites to evaluate duplex, narrowband Internet of Things (IoT) connectivity solutions for remote and mobile sensors. Each of the the proposed satellites has a 1U form factor.[1]

The satellites will use VHF band frequencies for communications. There will also be an experimental deployment of three ground stations in the United States for communications with the space units. The VHF frequencies proposed in this application, more specifically in the 137-138 MHz and 148-150.05 MHz bands, are allocated on a primary basis for Mobile Satellite Service (MSS) communications for non-Federal, non-voice, non-geostationary orbit (NGSO) systems, and are capable [redacted]

Swarm requests experimental authority to [redacted]

Experimental Program Description

The proposed architecture is comprised of both space and ground units [redacted]

[1] The basic unit for the cubesat form factor ("1U") is a 10x10x10 cm cube weighing less than 1.33 kg. Swarm satellites fit within standard CubeSat deployers.

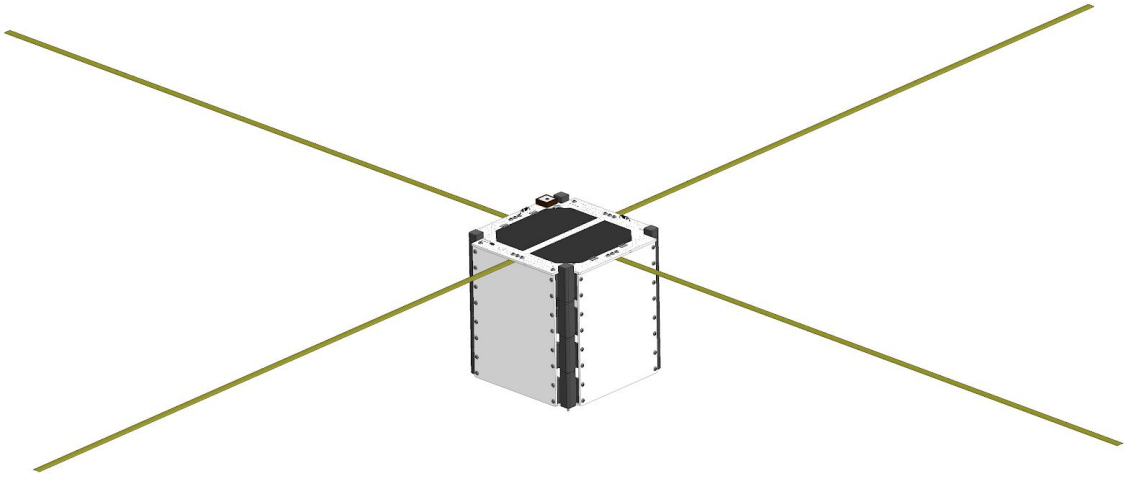

Figure 1: Image of a single satellite.

The satellite contains a battery [redacted] There are solar panels that provide recharge, maintaining a positive orbit average net power and allowing the satellite to potentially remain operational for up to 10 years (longer than the expected orbital lifetime). [redacted] Communication between space and ground elements uses VHF frequencies.

The goals of the proposed experimental deployment differ from and expand upon those provided in Swarm's previous filing for Experimental Special Temporary Authorization (0976-EX-ST-2018, granted October 1, 2018). The experimental program described herein is designed to meet the following objectives and validations:

- [redacted]
  - [redacted]
  - [redacted]
  - [redacted]
- [redacted]

[redacted]

General Description of the Overall System and Operations

The Swarm satellite network consists of two data relay satellites and three ground stations [redacted]

The system architecture consists of ground stations [redacted] All uplink and downlink transmissions will be one-way.

The satellites and ground stations will transmit only upon command and persist only during active data transmissions. Any transmission can be immediately terminated by ground command if interference is detected or reported. [redacted]

Public Interest Consideration

The commission's grant of this application will serve the public interest by allowing Swarm to demonstrate the above described [redacted]

Launch, Orbital Parameters, and Lifetime

The experimental deployment space launch is planned for the Rocket Lab launch vehicle scheduled for February 2019 into a Low Earth Orbit (LEO) at approximately 475 km altitude. The Swarm satellite does not employ propulsion or other active orbit maintenance technology, and with its low mass, the orbit will naturally decay and re-enter the atmosphere within approximately 3.2 years (nominal scenario, see ODAR in Exhibit B for more details) and completely burn up before reaching the ground. Table 1 details the anticipated orbit parameters.

Table 1: Anticipated orbit for Swarm satellites.

Orbital Parameters	Values	Accuracy
Inclination Angle (deg.)	45.0	+/- 1
Apogee (km)	475	+/- 50
Perigee (km)	475	+/- 50
Semi-major Axis (km)	475	+/- 50

Orbital Debris and Assessment Report (ODAR) and Radar Tracking

Exhibit B attached to this application describes fully the orbital debris and assessment report requirements pursuant to 47 C.F.R. § 5.64.

Non-Interference Criterion

Pursuant to 47 C.F.R. § 5.84 and 5.85, it is understood that a grant of authority for this experimental program will be on a non-exclusive and non-interference basis to both Federal and non-Federal authorized users of the VHF spectrum proposed in this application. Operations under

the experimental program will be conducted only at the three coordinated ground stations. Exhibit C attached to this application describes fully the electromagnetic compatibility of the Swarm system with other users and services in the VHF frequencies proposed in this application, more specifically in the 137-138 and 148-150.05 MHz bands.[2]

Power Flux Density Calculation at Earth's Surface

In compliance with Section 25.142 of the Commission's rules, in the 137-138 MHz band the power flux density (PFD) at the Earth's surface produced by the satellite will not exceed -129 dB(W/m²) in any 4 kHz band at any angle of arrival. Swarm ground stations transmit with a power spectral density (PSD) of -5.4 dBW/4kHz.

The out of band emissions are minimized by digital modulation techniques and filtering with at least 20 dB spectral rolloff at 120% of signal bandwidth in any 4 kHz band, 40 dB at 200% bandwidth, 55 dB at 300% bandwidth, and more than 60 dB beyond 4 times the bandwidth. Channels with center frequencies of 137.895, 137.925, 137.955, and 137.985 MHz (space-to-ground) and 148.315, 148.345, 148.375, and 148.405 MHz (ground-to-space) are chosen to remain within the band allocated to NGSO MSS, minimizing potential for interference into adjacent services, including allowance for Doppler shift and frequency tolerance.

Radio System Technical Characteristics

The link parameters for ground-to-space and space-to-ground communications are further characterized in the link budget provided in Table 2.

[2] On October 16, 2018, Swarm contacted ORBCOMM, the only mobile satellite service provider licensed to conduct commercial operations in the United States in the 137-138 and 148-150.05 MHz bands, to initiate coordination to prevent interference with ORBCOMM's system. Coordination between Swarm and ORBCOMM remains ongoing. Swarm appreciates that operations in the proposed VHF frequencies must occur on a sufferance basis, and Swarm cannot create interference and must accept interference from other authorized users. Should the Commission act prior to the conclusion of discussions with ORBCOMM, Swarm will accept a condition on its grant of experimental authority that requires successful coordination prior to the initiation of communications.

Table 2: Space and ground link budget.

	ground to satellite		satellite to ground		
Item	**Nominal**	**Worst-Case**	**Nominal**	**Worst-Case**	**Units**
Satellite Orbital Altitude	**475**	**475**	**475**	**475**	km
Earth Radius	6371	6371	6371	6371	km
Frequency	0.149	0.149	0.138	0.138	GHz
Elevation Angle to Satellite	50	0	50	0	deg
Satellite Angle from Nadir	36.74	68.53	36.74	68.53	deg
Theta Angle	3.26	21.47	3.26	21.47	deg
Transmitter Power	**1.50**	**1.50**	**1.50**	**1.50**	Watts
Transmitter Power	1.76	1.76	1.76	1.76	dBW
Transmitter Line Loss	-1.00	-1.00	-1.00	-1.00	dBW
Peak Transmit Antenna Gain	11.00	11.00	0.00	0.00	dBi
Transmit Antenna Pattern Loss	-3.84	0.00	-1.19	-2.99	dB
Transmit Total Gain	6.16	10.00	-2.19	-3.99	dB
Eq. Isotropic Radiated Power	**7.92**	**11.76**	**-0.43**	**-2.23**	**dBW**
Propagation Path Length	606	2506	606	2506	km
Path Loss	-131.56	-143.89	-130.89	-143.23	dB
Polarization Loss	-3.00	-3.00	-3.00	-3.00	dB
Power @ Receiver Antenna	**-126.64**	**-135.13**	**-134.32**	**-148.46**	**dBW**
Peak Receive Antenna Gain	0.00	0.00	11.00	11.00	dBi
Receive Antenna Line Loss	-1.00	-1.00	-1.00	-1.00	dB
Receive Antenna Pattern Loss	-1.19	-2.99	-4.46	-0.62	dB
Rx Gain with pointing error	-2.19	-3.99	5.54	9.38	dB
Rx Power	**-128.83**	**-139.13**	**-128.79**	**-139.08**	**dBW**
Necessary Bandwidth	20.8	20.8	20.8	20.8	kHz
Assigned Bandwidth per Channel	30.0	30.0	30.0	30.0	kHz
Target Rx Level	-162.80	-162.80	-162.80	-162.80	dBW
Implementation Margin	6	6	6	6	dB
Remaining Margin	**27.97**	**17.67**	**28.01**	**17.72**	**dB**

The satellite antenna is a turnstile antenna consisting of two half-wave dipole antennas aligned at right angles and fed 90 degrees out of phase. This provides an omnidirectional circular polarization pattern that improves communication with linear polarized antennas on the ground over all orientations. For the ground stations, two different types of antennas will be evaluated: 1) a vertically polarized half-wave monopole antenna with a maximum gain of 2 dBi, and 2) a 5-element Yagi antenna with a maximum gain of 11 dBi.[3] Figures 2 through 4 show the space

[3] The antenna gain value provided in the accompanying STA Form reflects the highest-gain antenna that will be used with Swarm's ground stations.

and ground antenna patterns and characteristics, applicable for both transmit and receive.

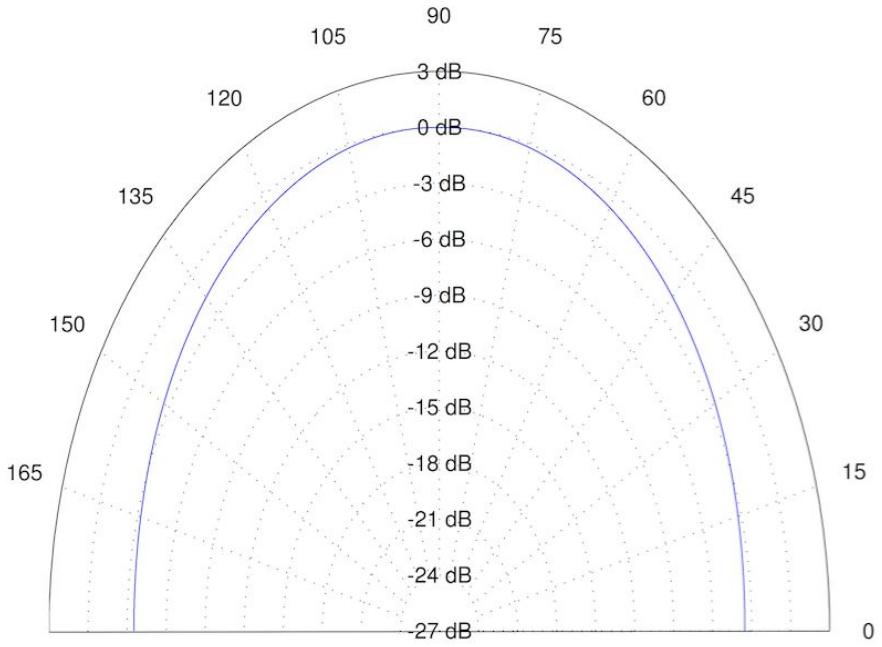

Figure 2: Satellite TX and RX antenna pattern.

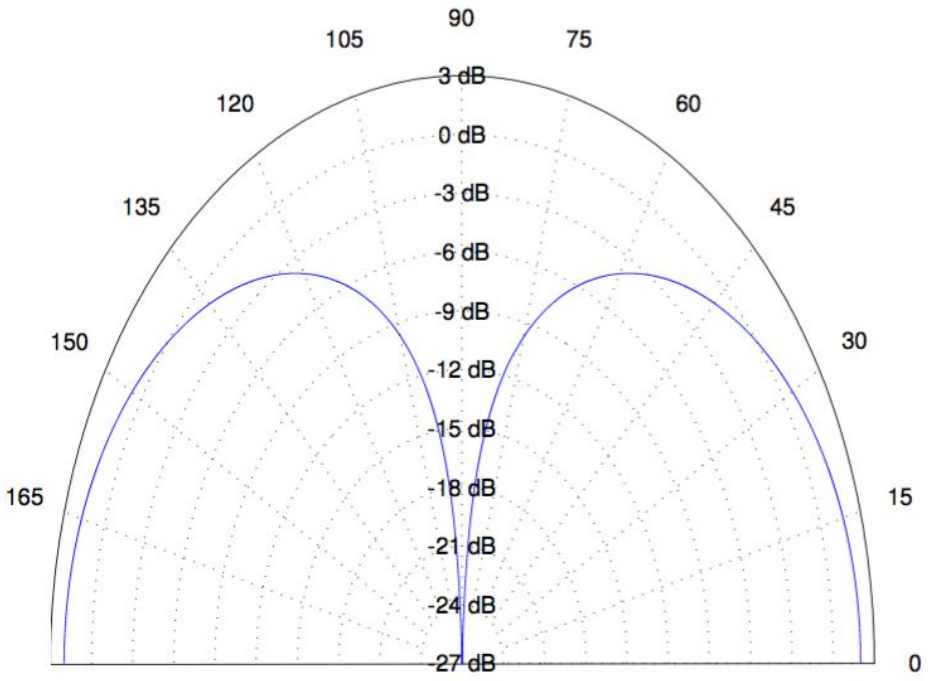

Figure 3: Ground station TX and RX antenna pattern (end-fed vertical monopole antenna).

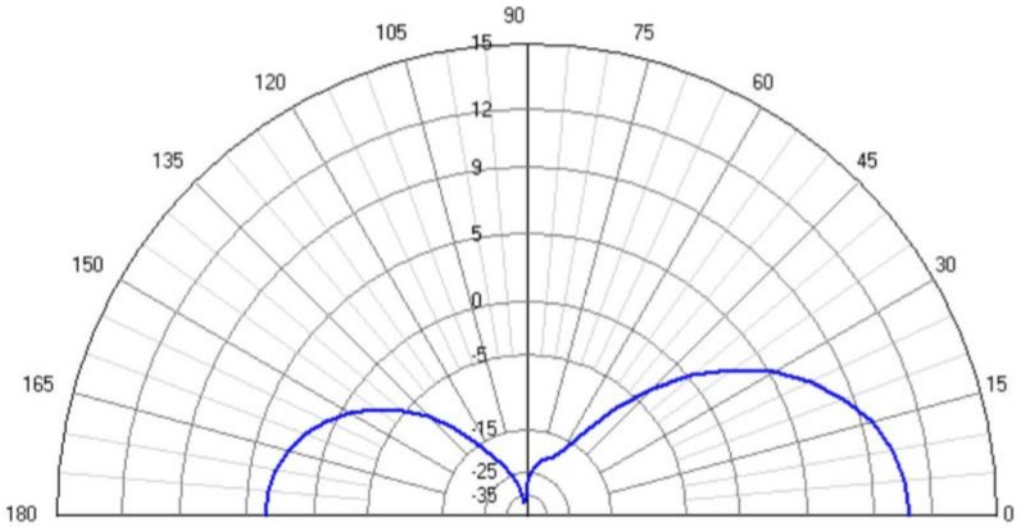

Figure 4: Ground station TX and RX antenna pattern (Yagi antenna).

All satellite to ground station communications initiate upon command and self terminate at the completion of the data transmission. If any deviation from the authorized technical requirements of the transmission is detected, the ground system will mute further transmissions until the deviation is understood and can be corrected.

Swarm requests a waiver of rule 47 C.F.R. § 5.115 related to station identification. More specifically, Swarm requests a waiver of the requirement for periodic station identification in the interest of minimizing transmission durations and activity. Grant of such waiver serves the public interest, as compliance with the station identification requirement unnecessarily adds additional data and modulation changes during transmissions. Grant of such waiver does not adversely affect the spectrum rights of any third party and is consistent with Commission's longstanding commitment to spectral efficiency.

Ground Station Locations

Ground Station 1
845 Madonna Way
Los Altos, CA 94024
lat/long (NAD83): 37.3648, -122.1108, 132 m
Antenna height: 3 meters above ground level
Antenna type: VHF vertical monopole or Yagi antenna

Ground Station 2
5967 McEver Road
Flowery Branch, GA 30542
lat/long (NAD83): 34.1913, -83.9415, 354 m

Antenna height: 3 meters above ground level
Antenna type: VHF vertical monopole or Yagi antenna

Ground Station 3
14963 S. Canyon Pointe Rd.
Draper, UT 84020
lat/long (NAD83): 40.4814, -111.8230, 1796m
Antenna height: 3 meters above ground level
Antenna type: VHF vertical monopole or Yagi antenna

ITU Advance Publication and Cost Recovery

Pursuant to 47 C.F.R. § 25.111 for space systems, it is understood that the commission will submit filings to the ITU on behalf of the applicant pursuant to international obligations for the coordination and registration of space network systems. Swarm will provide the commission the appropriate electronic files for submission to the ITU and hereby provides its commitment to the cost recovery of any such filings to the ITU.