

## REQUEST FOR SPECIAL TEMPORARY AUTHORITY

Swarm Technologies, Inc. (“Swarm”), pursuant to Section 25.120 of the Commission’s rules, hereby requests Special Temporary Authority (“STA”) to operate its gateway earth station to communicate with the first satellites launched as part of its planned 150 satellite non-geostationary orbit (“NGSO”) constellation.

Swarm currently has an application pending for a VHF gateway earth station located in Mountain View, CA (Public Notice released on October 15, 2019).<sup>1</sup> Swarm would operate the earth station under an STA with the technical characteristics set forth in the application. The gateway earth station will operate on frequencies in the 148-149.95 MHz (uplink) and 137- 138 MHz (downlink) bands, consistent with Swarm’s space station authorization.

This request is supported by good cause. Swarm seeks authority to communicate with the Swarm NGSO satellites to conduct in-orbit testing after launch. This will allow Swarm to confirm the operational status of its satellites beginning immediately after orbital insertion. Accordingly, the STA will serve the public interest by promoting the health and safety of Swarm’s NGSO constellation and thereby enhancing space safety.

Swarm will operate on a non-interference basis. As set forth in the underlying earth station application, the gateway will protect terrestrial and space systems in shared spectrum bands consistent with FCC rules.

The first set of Swarm satellites is scheduled to be launched in late December 2019. Accordingly, Swarm requests that the Commission issue an STA structured to begin on the launch date and remain in force for up to 60 days.

For convenience, below is supplemental information that was included in the narrative of the gateway license application.

### **Frequencies and Emissions**

To supplement the information provided in the Form 312, Main Form and Schedule B, additional information regarding the operating frequencies and emission characteristics of Swarm’s proposed earth station is provided below.

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<sup>1</sup> The IBFS file number for this earth station application is SES-LIC-20190806-01029. The application contains all relevant operational characteristics and is hereby incorporated herein to the extent necessary.

## Frequencies

A complete listing of the requested frequencies on which Swarm's earth station will transmit and receive is provided in Table 1. These frequencies are identical to those granted in Swarm's authorization for its corresponding 150-satellite system.<sup>2</sup>

**Table 1.** Frequencies on which Swarm's earth station will transmit and receive.

Lower Frequency (MHz)	Upper Frequency (MHz)	Transmit or Receive Mode	Nature of Service
137.0250	137.1750	Receive	NVNG MSS
137.3275	137.3750	Receive	NVNG MSS
137.4725	137.5350	Receive	NVNG MSS
137.5850	137.6500	Receive	NVNG MSS
137.8125	138.0000	Receive	NVNG MSS
148.2500	148.5850	Transmit	NVNG MSS
148.6350	148.7500	Transmit	NVNG MSS
149.9000	149.9500	Transmit	NVNG MSS

## Emission Characteristics

Swarm's proposed earth station will operate on channels within the uplink and downlink frequencies provided in Table 1. The earth station will only transmit on a single channel at any given time. Both the Swarm satellites and earth station are capable of operating with a variety of emissions designators, and Swarm may vary, within the range specified in this application, the bandwidth of channels on which the earth station transmits and receives to best serve customer and network needs and maximize spectral efficiency. Consistent with 47 C.F.R. § 25.275, Swarm specifies in Schedule B only those carriers with the highest Effective Isotropic Radiated Power ("EIRP") density, narrowest bandwidth, and largest bandwidth, and will transmit using

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<sup>2</sup> *Swarm Grant* ¶ 18; Space Station Application, Narrative Exhibit at 9.

emissions not specifically listed only if doing so would “not exceed the highest EIRP, EIRP density, and bandwidth prescribed for any listed emission.”<sup>3</sup> For completeness, information regarding the characteristics of additional emissions designators and their corresponding power, EIRP, and EIRP density levels is provided in Table 2 below. In each case, the assigned bandwidth includes an appropriate frequency allowance to account for Doppler shift and frequency tolerance. Emissions specified in Schedule B are highlighted in blue and define the maximum bandwidth, EIRP, and EIRP density with which the earth station will transmit.

**Table 2.** Potential bandwidths, power levels, and EIRP levels for earth station transmissions.<sup>4</sup>

<b>Emission Designator</b>	<b>Necessary Bandwidth (kHz)</b>	<b>Assigned Bandwidth (kHz)</b>	<b>Power Level (W)</b>	<b>Max EIRP (dBW)</b>	<b>Max EIRP Density (dBW/4kHz)</b>
7K80F1D	7.8	16.0	10.0	21.0	18.1
10K4F1D	10.4	20.0	10.0	21.0	16.9
15K6F1D	15.6	24.0	10.0	21.0	15.1
20K8F1D	20.8	30.0	10.0	21.0	13.8
31K3F1D	31.3	40.0	10.0	21.0	12.1
41K7F1D	41.7	50.0	10.0	21.0	10.8
62K5F1D	62.5	72.0	10.0	21.0	9.1
125KF1D	125.0	134.0	10.0	21.0	6.1
250KF1D	250.0	259.0	10.0	21.0	3.0

<sup>3</sup> 47 C.F.R. § 25.275(c).

<sup>4</sup> To provide an upper bound on the maximum EIRP and EIRP density levels, the values provided in Table 2 were calculated using the maximum antenna gain of 11.0 dBi. As described in the accompanying Form 312 Schedule B, the proposed earth station will be transmit using one of four antennas with gain values of 2.0 dBi, 5.5 dBi, 0.0 dBi, and 11.0 dBi. Only one antenna will transmit at any given time.

*Half-Power Beam Width (47 C.F.R. § 25.130(f))*

Swarm's gateway earth station will transmit using one of the four antennas whose specifications are provided in the accompanying Form 312 Schedule B. The half-power beam widths for the antennas are as follows:

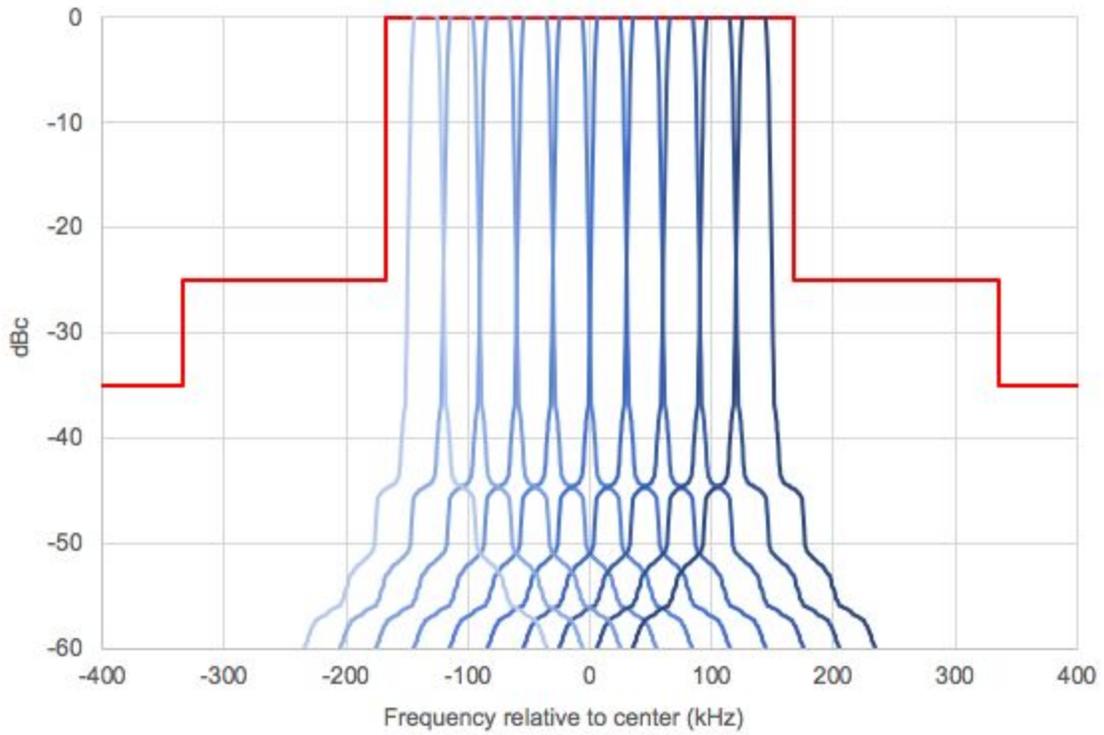
<b>Antenna ID</b>	<b>Model</b>	<b>Maximum Gain (dBi)</b>	<b>Half-Power Beam Width (°)</b>
W1/2	001	2.0	29.0
COLINEAR	002	5.5	32.0
QFH	003	0.0	104.0
YAGI	004	11.0	52.0
W1/4	005	2.0	42.0

*Out-of-Band Emissions (47 C.F.R. § 25.202(f))*

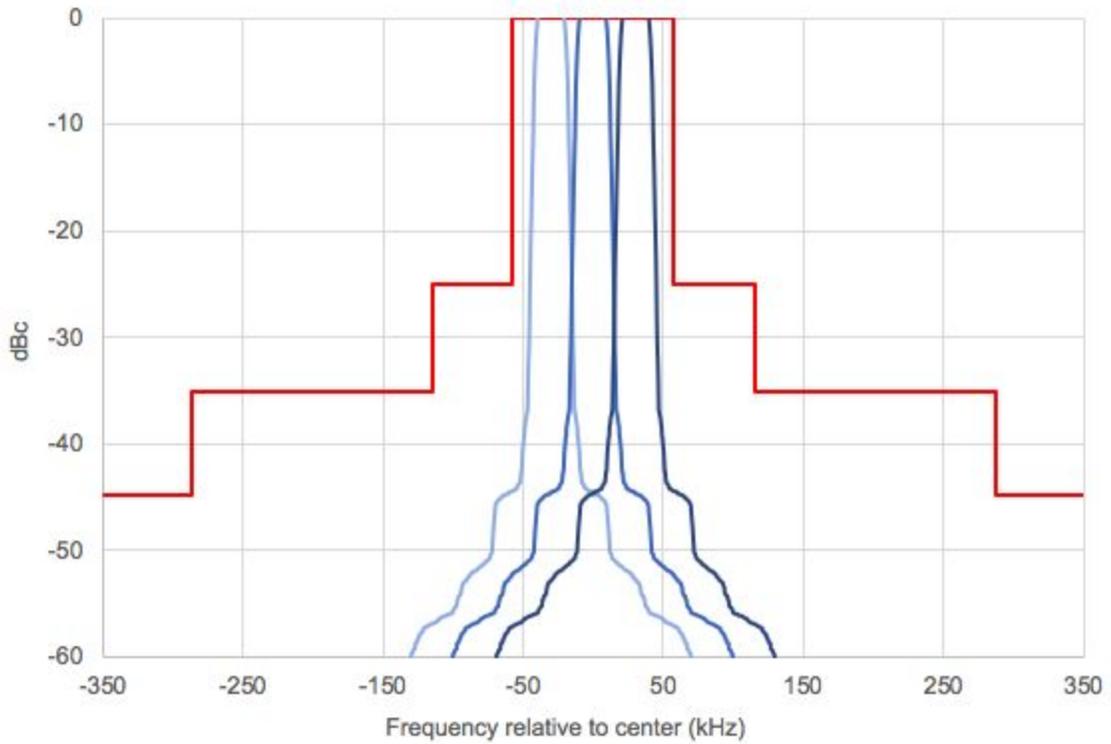
Figures 1-3 below show the channels on which the proposed gateway earth station will transmit. As discussed previously, the earth station will only transmit on a single channel at any given time. As shown, the spectrum masks for Swarm earth station emissions comply with the limits set forth in Section 25.202(f) of the Commission's rules.<sup>5</sup>

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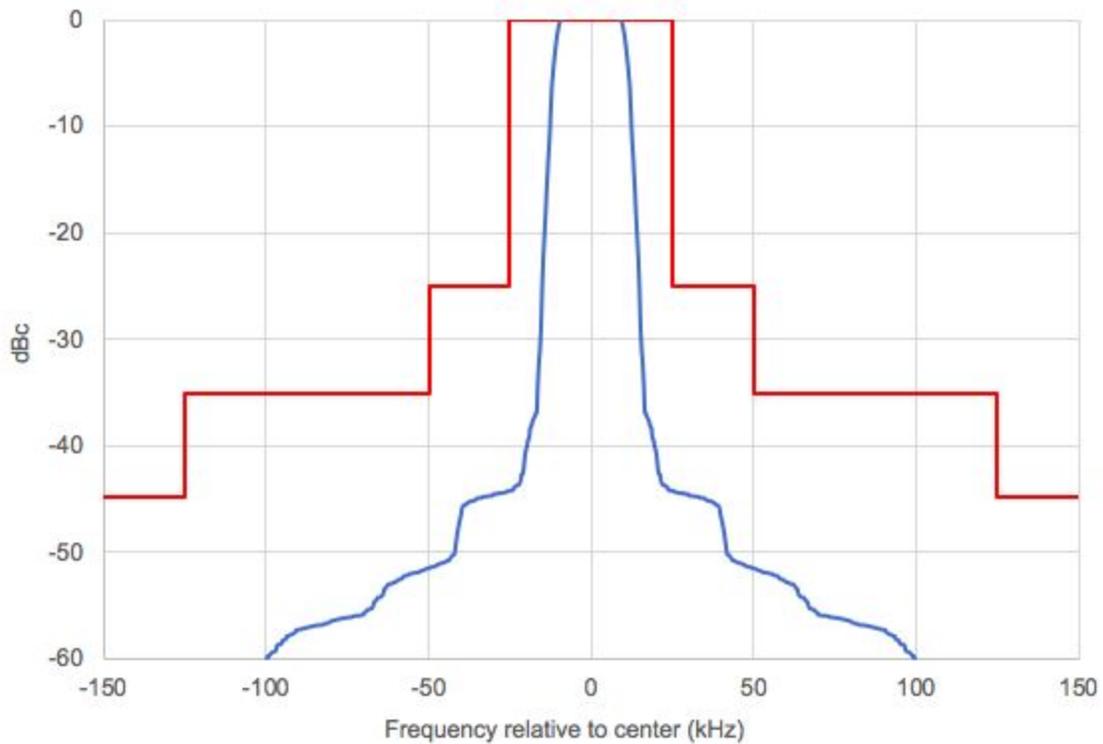
<sup>5</sup> Figures 1-3 reflect Swarm's nominal initial plan for transmissions, which consists of channels with a necessary bandwidth of 20.8 kHz and an assigned bandwidth of 30.0 kHz to account for Doppler shift and frequency tolerance. Transmissions using alternative emissions designators (see Table 2) will also comply with the emissions mask requirements shown for each frequency band.



**Figure 1.** Emission mask for the 148.250-148.585 MHz band.



**Figure 2.** Emission mask for the 148.635-148.750 MHz band.



**Figure 3.** Emission mask for the 149.000-149.950 MHz band.

*Frequency Tolerance (47 C.F.R. § 25.202(d))*

The carrier frequency of the earth station will be maintained within 0.001% of the reference frequency as required by Section 25.202(d) of the Commission's rules.

*Minimum Antenna Elevation Angle. (47 C.F.R. § 25.205(a))*

The Swarm earth station antennas will not transmit at elevation angles less than five degrees, measured from the horizontal plane to the direction of maximum radiation.

Respectfully submitted,

**Swarm Technologies, Inc.**

By:  /s/ Kalpak Gude

Kalpak Gude

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