Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
SWARM TECHNOLOGIES INC.	)	
	)	
Amendment to Application to Modify the	)	File No. SAT-AMD-20200504-00041
Authorization for the Swarm	)	File No. SAT-MOD-20200501-00040
NGSO Satellite System	)	

REPLY OF ORBCOMM LICENSE CORP.

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SUMMARY

ORBCOMM filed a Petition to Dismiss or Deny the Swarm Amendment Application, explaining how Swarm failed to include in its application the demonstration required by Section 25.142(a) of the Commission's Rules to show that Swarm "will not cause unacceptable interference" to ORBCOMM as an incumbent licensee. That rule codifies the first-in-time priority rights that underpin the satellite processing round procedures and the longstanding fundamental regulatory principle of first-in-time interference protection rights for incumbent licensees. In response, Swarm contends that Section 25.142(b)(3), which requires ORBCOMM to "cooperate fully and make every reasonable effort to resolve technical problems and conflicts that may inhibit effective and efficient use of the radio spectrum," somehow negates ORBCOMM's right to protection from interference. Swarm reads too much into that provision, because the priority rights codified in Section 25.142(a) are fully compatible with any coordination obligation under Section 25.142(b)(3).

Swarm also attempts to avoid its obligation to demonstrate how it will avoid causing unacceptable interference by claiming it need merely identify potential sharing techniques, and that it can rely on coordination to avoid causing unacceptable interference to ORBCOMM. That is not what the rule requires, but in any event, the four vaguely described potential sharing techniques proffered by Swarm will not be effective in preventing unacceptable interference to ORBCOMM from Swarm's operations.

The CSMA/CA with listen-before-talk would be ineffective, because the Swarm subscriber terminals would only "hear" ORBCOMM subscriber terminal transmissions that are relatively close to the Swarm device, and thus would not prevent Swarm from transmitting on channels actively in use by ORBCOMM subscriber terminals located within the entire remaining coverage area of an ORBCOMM satellite footprint, but outside of the very small radius where Swarm's subscriber terminals would detect those transmissions. ORBCOMM presents calculations of the unacceptable interference to ORBCOMM's satellite receivers that would occur from the resulting co-frequency Swarm subscriber uplink transmissions. These interference problems would be significantly exacerbated by Swarm's proposed wide uplink channels (up to 250 kHz), the proposed doubling in the number of Swarm satellites and attendant at least two-fold increase in Swarm's possible simultaneous spectrum occupancy, as well as the substantially longer burst duration and duty cycle of Swarm uplink transmissions if Swarm's US323 waiver request is granted. Swarm tries to defend the efficacy of its CSMA/CA technology as preventing interference from a Swarm subscriber terminal to an ORBCOMM subscriber terminal, but Swarm fundamentally misunderstands the sharing environment, because the ORBCOMM subscriber terminals do not receive in the uplink bands. Indeed, Swarm's attempted defense confirms that only nearby transmissions of ORBCOMM subscriber terminals could be detected by Swarm's terminals.

Nor do any of the other three proposed techniques provide any meaningful basis for sharing between Swarm and ORBCOMM without unacceptable interference to ORBCOMM. While "the comparatively low power (and low power density) of Swarm's transmissions in any given direction" may assist in limiting the interference radius of Swarm's terminals vis-a-vis

terrestrial fixed and mobile system operations, it affords no protection to ORBCOMM's satellite uplink receivers from Swarm's subscriber terminals. Swarm's suggestion of trying to utilize inter-system time-division multiple access technology would introduce inordinate complications that may not be reasonably solvable, and at a minimum would require ORBCOMM to re-engineer its system. And geographic sharing would likewise also prove ineffectual or impractical, particularly because so many NVNG MSS subscriber terminals are mobile.

ORBCOMM stands ready to fulfill its obligations under Section 25.143(b)(3) to cooperate with Swarm and other applicants. But any such good faith efforts by ORBCOMM would under no circumstances include forfeiting its first-in-time priority rights, and ORBCOMM is aware of no mechanism for involuntarily designating ORBCOMM as a party to the processing round. ORBCOMM believes that Swarm might be able to devise a viable means for modifying its proposed system by, among other things, incorporating effective active interference avoidance technology that can reliably facilitate shared service area, real-time co-frequency sharing of MES uplink spectrum between ORBCOMM and Swarm in accordance with ORBCOMM's first-in-time license rights. The successful pre-licensing agreement to share spectrum in this manner mutually entered into by three narrowband FDMA system applicants in the *Second Processing Round* certainly indicates that this should be possible.

ORBCOMM also continues to object to grant of the requested waiver of the US323 operating restrictions. Those restrictions were integral to the sharing arrangements that were incorporated into the Commission's Rules during the Second Processing Round, and grant of the waiver would significantly exacerbate the interference that Swarm would cause to ORBCOMM. Grant of a waiver must not undermine the public interest policy served by the rule, and in this case that public interest policy is preventing unacceptable interference.

ORBCOMM also finds it necessary to correct the record with respect to the numerous mischaracterizations of ORBCOMM and its satellite system in Swarm's Opposition. Contrary to Swarm's assertions, ORBCOMM is not a "monopolist," but faces competition from numerous terrestrial and satellite service providers. Indeed, Swarm is poised to commence service under the license granted to Swarm a mere seven months before it filed the *Amendment Application*, and that license gave Swarm everything it asked for in its initial application.

Swarm also mischaracterizes ORBCOMM's activities in Europe. Far from adopting a global spectrum sharing plan for NVNG MSS, the Commission explicitly recognized in adopting both the initial service rules and the Second Processing Round rules that foreign authorities have exclusive jurisdiction to determine satellite market entry policies, including uplink frequency assignment and spectrum sharing within their territories, giving due consideration to, among other things, foreign spectrum sharing environments that can obviously differ from the United States. The Commission recognizes that the European Administrations have the knowledge, expertise and sovereignty to address how such entry and spectrum sharing should occur within their borders.

Finally, Swarm takes out-of-context statements by ORBCOMM executives and cautionary language in ORBCOMM's SEC filings to create a false narrative of a supposedly inefficient, under-used, and obsolete satellite system. In fact, the cited discussion of only using two channels referred to downlinks, not uplinks. The purported "excess capacity" cited by Swarm in the ORBCOMM executive's statement refers to ORBCOMM's ability to surge network resources in high-demand areas and during peak demand periods. Similarly, Swarm erroneously claims that ORBCOMM is somehow spectrally inefficient because its satellites are capable of maximizing uplink throughput in spectrum that is heavily congested with worldwide terrestrial fixed and mobile service usage that cannot be disrupted under applicable regulation. Building in all of these robust and resilient capabilities into the ORBCOMM satellite system is anything but inefficiency – it is critical for providing reliable service to ORBCOMM's customers around the globe.

Leaving aside Swarm's inflammatory rhetoric and gross mischaracterizations, the simple fact is that Swarm has failed to submit any credible demonstration that it will not cause unacceptable interference to ORBCOMM, as specifically required by the NVNG MSS space segment licensing application Rules. On that basis alone, the Commission should either compel Swarm to amend its modification application accordingly, or dismiss or deny the *Amendment Application* as patently defective.

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REPLY OF ORBCOMM LICENSE CORP.

ORBCOMM License Corp. ("ORBCOMM"), pursuant to Section 25.154(d) of the Commission's Rules, hereby replies to the Consolidated Response and Opposition of Swarm Technologies, Inc. ("Swarm")[1] with regard to the above-captioned applications (collectively, the "*Amendment Application*").[2] Stripped of the inflammatory rhetoric and gross mischaracterizations of (i) ORBCOMM's Petition to Dismiss or Deny (the "*ORBCOMM Petition*"), (ii) ORBCOMM's system and (iii) ORBCOMM's statements to investors, Swarm is left with trying to convince the Commission that it should ignore Section 25.142(a)(1) of the Commission's Rules – which embodies the longstanding fundamental regulatory principle of first-in-time interference protection rights for incumbent licensees. That provision requires Swarm to demonstrate in its application that "that they will not cause unacceptable interference

[1] The Consolidated Response and Opposition of Swarm will hereafter be cited as "*Swarm Opposition*."

[2] The Amendment Application is inextricably linked to the Modification Application, because it is an amendment to that application. ORBCOMM thus filed its Petition to Dismiss or Deny in both files. However, ORBCOMM does not object to the Modification Application, because those changes will not adversely affect ORBCOMM.

to any non-voice, non-geostationary mobile-satellite service system authorized to construct or operate." Swarm has repeatedly confirmed ORBCOMM's incumbent licensee rights when it was convenient to do so in the context of the initial Swarm Part 25 application.[3] Now, Swarm is attempting to obfuscate away ORBCOMM's interference protection rights vis-à-vis new NVNG MSS system entrants. Putting all of Swarm's Orwellian semantic gymnastics aside, the simple fact is that Swarm has failed to make the required showing that its proposed modifications will not cause unacceptable interference to ORBCOMM in either the *Amendment Application* or the *Swarm Opposition*. The Commission should thus dismiss or deny the *Amendment Application.*

ORBCOMM is Entitled to Protection from Unacceptable Interference Caused by Swarm

The non-voice, non-geostationary mobile-satellite service ("NVNG MSS") Rules unambiguously codify a first-in-time priority right to protection in Section 25.142(a) by requiring applicants to demonstrate how they will avoid causing unacceptable interference to previous licensees.[4] Section 25.142(a) reflects the general Commission policy of establishing

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[3] *See, e.g.*, Swarm Initial Application Narrative Exhibit at p. 26:

> Swarm requests assignment of a subset of frequencies in the Little LEO bands that are not currently assigned to ORBCOMM on a primary basis. ORBCOMM was granted primary assignment of frequencies as a result of a processing round and rulemaking in 1997 and 1998, and was granted primary assignment of additional "System 1" frequencies in 2008. (citations omitted)

See also, Swarm Initial Application Consolidated Opposition, Filed April 15, 2019 at p. 2 ("But Swarm did not apply to operate in any band segments in which ORBCOMM can claim a right to protection from harmful interference. While ORBCOMM has primary rights to operate in *some* portions of the 148-150 MHz band, Swarm has applied to operate only in *other* band segments, where ORBCOMM has temporary, secondary rights that automatically cease to exist upon the launch of a second NVNG MSS system.").

[4] The fact that ORBCOMM's first-in-time priority rights are not specified in its licenses (*Swarm Opposition* at p. 13) is not surprising, because the Commission codified such rights in the Rules, and because the Commission would not generally address other licensees' or

relative-priority amongst applicants in a processing round, and between applicants and licensees from earlier processing rounds.[5] Swarm attempts to argue that the NVNG MSS codified priority is negated by a separate provision in that section of the rules requiring NVNG MSS licensees to "at the direction of the Commission, cooperate fully and make every reasonable effort to resolve technical problems and conflicts that may inhibit effective and efficient use of the radio spectrum."[6] Swarm also characterizes this as an obligation on behalf of ORBCOMM to coordinate with Swarm.[7]

Assuming *arguendo* ORBCOMM has an obligation to "coordinate,"[8] there is nothing at all inconsistent with both requiring ORBCOMM to coordinate (or cooperate fully and make every reasonable effort to resolve technical problems and conflicts), and recognizing that

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applicants' spectrum obligations in ORBCOMM's license. The ORBCOMM license does indicate that the frequencies at issue here assigned to ORBCOMM "shall be on a primary basis." *Orbcomm License Corp*., 23 FCC Rcd 4804 (2008) at ¶¶ 22.a. and 23.a. Indeed, Swarm's initial application acknowledged ORBCOMM's primary status with regard to these frequencies (but in that application made clear it was not seeking to operate in those sub-bands). *See, e.g*., Swarm Initial Application Narrative Exhibit at p. 26

[5] *E.g., Kuiper Systems, LLC*, IBFS File No. SAT-LOA-20190704-00057, Erratum released September 4, 2020. The use of processing rounds themselves is a means of establishing which applicants are entitled to consideration for access to spectrum awarded in that processing round, with later-filed applicants submitted after the deadline being deemed ineligible for consideration. Swarm clearly understands this policy, having indicated in the *Amendment Application* Narrative Statement at p. 1: "Swarm submits this application for consideration as part of the non-geostationary satellite orbit (NGSO) satellite processing round the International Bureau established on March 5, 2020."

[6] *Swarm Opposition* at pp. 7-8, citing 47 C.F.R. § 25.142(b)(3).

[7] *Swarm Opposition* at p. 8 ("Importantly, the obligation to coordinate applies to '*[a]ll* affected applicants, permittees, and licensees,' and not just ORBCOMM's competitive target – Swarm".).

[8] The specified provision obligates ORBCOMM, "at the direction of the Commission," to "cooperate fully and make every reasonable effort to resolve technical problems and conflicts."

ORBCOMM retains first-in-time priority rights to its licensed spectrum during any such coordination. Coordination does not mean that each of the parties has equal rights to access any shared spectrum. "Coordination" is not defined in the Telecommunications Act or in Part 25.[9] But the Commission's Rules are replete with examples of Commission-directed coordination where the incumbent has priority rights to be protected from interference.[10]

Likewise, there is no merit to Swarm's claims that ORBCOMM has an obligation to share the NVNG MSS spectrum on an equal basis that overrides the first-in-time priority rights reflected in Section 25.142(a)(1).[11] Far from being "implausible" or "obtuse," ORBCOMM's incumbent licensee interference protection rights are grounded in the straightforward language in the Commission's NVNG MSS regulations, the policies undergirding the use of processing rounds, and the fact that there is no incompatibility between sharing and/or coordination, on the one hand, and recognition of first-in-time priority rights. Nor is ORBCOMM categorically unwilling to "share" the spectrum, notwithstanding Swarm's assertions otherwise.[12] ORBCOMM once again reiterates as it has consistently stated on the record since Swarm submitted its original Part 25 space segment license application that is fully prepared to share

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9 *See,* 47 U.S.C. § 153 and 47 C.F.R. § 25.103.

10 *E.g.*, 47 C.F.R. § 25.203(c); 47 C.F.R. §§ 101.103(b), (d) and (e).

11 *E.g*., *Swarm Opposition* at p. 7:

> The bulk of ORBCOMM's petition argues that Swarm's Amendment does not satisfy the requirements of 47 C.F.R. § 25.142(a)(1). These arguments are implausible in the extreme - and rest on a deliberately obtuse understanding of ORBCOMM's obligation to share VHF with other operators.

12 *E.g*., *Amendment Application* at pp. 13 and 16. As discussed below, however, any sharing must recognize ORBCOMM's first-in-time priority rights. See pp. 4-6, *infra*.

spectrum in accordance with its NVNG MSS license rights and the applicable Commission Rules and policies.[13]

. The *ORBCOMM Petition* demonstrated that, as currently architected, the modified Swarm system proposed in the *Amendment Application* is not technically capable of co-frequency sharing in the same service area without causing unacceptable interference to ORBCOMM.[14] This defect is in clear contravention of Section 25.142(a)(1). Furthermore, the technical inability of the Swarm system to share spectrum with ORBCOMM on a co-frequency co-coverage basis cannot somehow magically be solved by post-licensing coordination as Swarm continues to assert.[15] The *Swarm Opposition* has done nothing to refute these facts.

Instead, Swarm continues to ignore the fatal flaws in the proposed sharing technology and techniques it references in the *Amendment Application* and instead erroneously continues to claim that post-licensing coordination should be the only approach needed. All obfuscation aside, based on what Swarm has proposed to date, the only way that ORBCOMM and the proposed Swarm system could "coordinate" spectrum sharing without unacceptable interference to ORBCOMM would be through band segmentation – an unjustifiable result that would defy long-established fundamental spectrum management principles, improperly negate ORBCOMM's licensing rights, and set dangerous precedent. The Commission should deny Swarm's thinly veiled attempt to push forward with a Swarm satellite system design that simply

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[13] *E.g.*, ORBCOMM *Petition* at p. 7; ORBCOMM Petition to Dismiss, Deny or Hold in Abeyance, Filed April 1, 2019 at p. 6; Ex Parte Letter regarding File No. SAT-LOA-20181221-00094, filed by ORBCOMM on May 23, 2019 at p. 3.

[14] ORBCOMM *Petition* at pp. 12-14.

[15] *Swarm Opposition* at p. 8.

cannot co-frequency share with ORBCOMM (or any other narrowband NVNG MSS satellite constellation providing near real-time continuous coverage) without causing unacceptable interference.

Swarm erroneously suggests that at the very least, ORBCOMM is not entitled to any protection with regard to certain sub-bands, because it had previously agreed to share that spectrum with other NVNG MSS systems in the Second Processing Round.[16] There are several significant flaws with this argument. As an initial matter, the current situation is notably different from the second NVNG MSS processing round. ORBCOMM relinquished its first-in-time priority rights to its first-round spectrum assignments in the Second Processing Round, because ORBCOMM had voluntarily entered the Second Processing Round in order to obtain access to additional spectrum.[17] During the course of complicated, multi-party (all of whom had equal priority) discussions, the second round applicants as a whole reached a pre-licensing sharing agreement that all parties agreed would not lead to unacceptable interference. Furthermore, that sharing arrangement was premised on specific system designs, all of which incorporated specific frequency sharing technologies that were mutually verified and accepted by all of the applicants prior to licensing. Swarm clearly should not be allowed to rely on the Second Processing Round sharing agreement, when its proposed system design obviously does not comport with the agreed-to active inter-system interference avoidance capabilities and other specific operational limitations for each system that formed the basis of the mutual agreement among the Second Processing Round applicants.

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16 *Swarm Opposition* at p. 14.

17 *Orbital Communications Corporation,* 13 FCC Rcd. 10828 (1998) at ¶¶ 3 and 21.

Moreover, it is hypocritical of Swarm to seek to rely on the Second Processing Round agreement when it benefits it, but decry that agreement as a "a long-defunct round that predated its formation by decades"[18] when that settlement agreement is inconsistent with Swarm's desires. Regardless, nothing in the Second Processing Round agreement concerning inter-system sharing obviates the Section 25.142(a)(1) obligation on Swarm to demonstrate in its application that it will not cause harmful interference to ORBCOMM, which has first-in-time priority rights.

Swarm Continues to Fail to Meet the Obligations of Section 25.142(a)(1)

Swarm failed to include in the *Amendment Application* any valid "showing, based on existing system information publicly available at the Commission at the time of filing, that they will not cause unacceptable interference to any non-voice, non-geostationary mobile-satellite service system authorized to construct or operate." notwithstanding the clear directive of Section 25.142(a)(1) of the Commission's Rules. Nor was this patent defect corrected by the *Swarm Opposition*. Instead, as explained above, Swarm seeks to obfuscate that requirement out of the Rules. In the alternative, Swarm attempts to change that requirement, postulating that they need only identify a "mechanism for avoiding unacceptable interference to existing NVNG MSS licensees: intersystem coordination."[19] The Commission should reject Swarm's effort to invoke Section 25.142(b)(3) to not only negate the first-in-time priority rights of ORBCOMM embedded in Section 25.142(a)(1), but also to eliminate the required demonstration (and vetting) of the specific capabilities and techniques that the proposed Swarm system will incorporate that will allow it to operate on a co-frequency co-coverage basis without causing unacceptable interference to ORBCOMM.

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[18] *Swarm Opposition* at p. 13.

[19] *Swarm Opposition* at pp. 7-8.

Under Swarm's theory, rather than include the required demonstration, it need only claim that vaguely described "sharing strategies will enable it to share spectrum effectively with ORBCOMM."[20] Swarm listed four possible techniques in the *Amendment Application* that it asserted might be used to avoid unacceptable interference: (1) Swarm's version of Carrier-Sense Multiple Access media access control protocol with Collision Avoidance (CSMA/CA), that employs a mobile earth station-based "listen-before-talk" protocol to verify the absence of other traffic before transmitting on a given channel; (2) the comparatively low power (and low power density) of Swarm's transmissions in any given direction; (3) inter-system time-division multiple access (TDMA) and; (4) geographic sharing techniques.[21] The *ORBCOMM Petition* fully explained why none of the sharing technologies and techniques identified in the *Amendment Application* would allow Swarm's proposed system to operate without causing unacceptable interference to ORBCOMM.[22] Swarm's Opposition not only failed to refute ORBCOMM's showing, but indeed its attempted response to bolster its "sharing capabilities" confirms the ineffectiveness of those claimed sharing solutions.

The fundamental problem with Swarm's proposed reliance on CSMA/CA is that it does nothing to prevent Swarm from simultaneously transmitting on the same frequency as an ORBCOMM subscriber terminal (unless the ORBCOMM terminal is operating close to the Swarm terminal), which will create interference to the ORBCOMM satellite uplink receiver. Attached as an Appendix are the more detailed calculations of the interference caused by Swarm. Indeed, the *Swarm Opposition* at page 11 confirms this problem with Swarm's CSMA/CA

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[20] *Amendment Application* at p. 30.

[21] *Amendment Application* at pp. 30-31.

[22] *ORBCOMM Petition*, at pp. 8-12.

causing intersatellite system interference problems, because it recognizes that Swarm will not detect ORBCOMM MES transmissions beyond a limited range from their "listening" terminals -- but the Swarm transmissions will reach the ORBCOMM satellites.

Swarm's attempted defense of its CSMA/CA reflects a complete misunderstanding or intentional disregard of the sharing environment. The problem is not with Swarm uplink transmissions directly causing interference to ORBCOMM's subscriber terminals,[23] because ORBCOMM terminals *do not receive in the uplink band*.[24] Rather, the problem is that the Swarm transmissions will cause interference at the ORBCOMM satellite uplink receivers, because they can be simultaneously transmitting on channels in active use by ORBCOMM subscriber terminal transmitters that are not sensed by the Swarm terminals. Figure 1 and Figure 2 below illustrate this problem. Additionally, **ATTACHMENT 1** provides calculations demonstrating the magnitude of unacceptable interference (*i.e.*, *complete blockage of intended ORBCOMM transmissions*) that ORBCOMM would suffer as a result.

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[23] *Swarm Opposition* at p. 11:

> But ORBCOMM does not explain why the LBT protections built into CSMA/CA would even be necessary if terminals are separated by significant distances, where pathloss alone would be adequate to protect these distant terminals in both blocked and unblocked line-of-sight scenarios—only the latter of which ORBCOMM cares to consider.

[24] As the *ORBCOMM Petition* explained, there are also questions with regard to Swarm's "listen-before-talk" capabilities, because their blanket subscriber terminal application did not indicate that their terminals will "listen" (receive) in the 148-149.9 MHz band. *ORBCOMM Petition*, at n. 24.

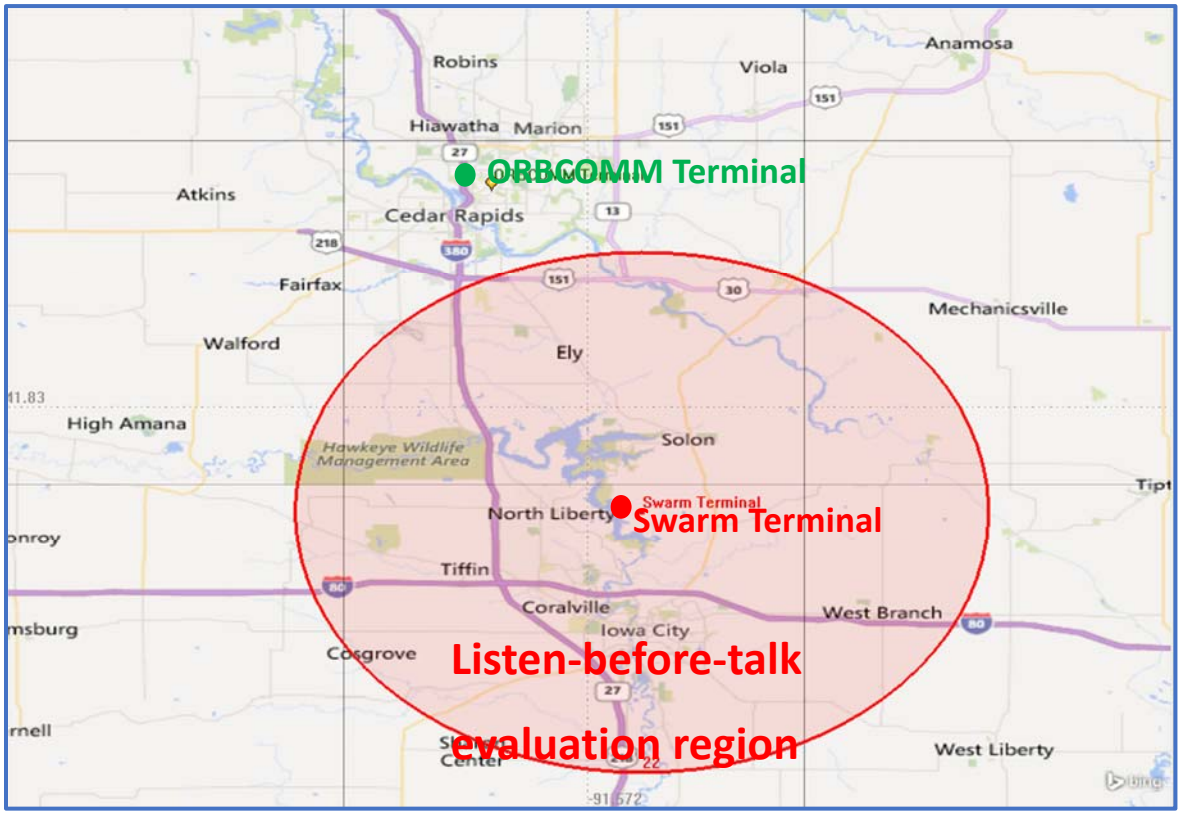

Figure 1 - ***Area in Which a Swarm Terminal can Detect an ORBCOMM Subscriber Terminal***

Figure 2 – *ORBCOMM Coverage Area in which a Swarm Transmission would Interfere With a Co-frequency ORBCOMM Uplink Transmission*

Figure 1 illustrates a Swarm terminal and an ORBCOMM terminal separated by just 30 kilometers, each mounted at 3 meters above the ground. The red circle in Figure 1 indicates the approximate maximum area from which the subject Swarm terminal CSMA/CA could detect spectrum occupied by other systems to make interference avoidance decisions based on Swarm's listen-before-talk protocol.

Figure 2 illustrates a single ORBCOMM satellite footprint coverage area overlaying the tiny Swarm interference detection zone. As shown in Figure 2, a single Swarm terminal transmitting on the wider channels proposed by Swarm could easily jam the simultaneous transmissions of tens of ORBCOMM terminals across the entire 5100 km receive footprint of a victim ORBCOMM satellite receiver. Even worse, in ORBCOMM constellation's coverage geometries where more than one ORBCOMM satellite is simultaneously in view of an interfering Swarm terminal, the resulting jamming of ORBCOMM transmissions could extend over a far larger combined victim receive footprint area, and the number of affected ORBCOMM user terminals could be far greater. Moreover, if Swarm's service is successful, the number of interfering Swarm user terminals simultaneously operating in a victim ORBCOMM satellite receiver footprint could even more severely degrade ORBCOMM access to available uplink spectrum.

This real potential for unacceptable to interference to ORBCOMM is in no way mitigated by Swarm's unsupported assertion regarding "the comparatively low power (and low power density) of Swarm's transmissions in any given direction." As stated in the *ORBCOMM Petition*, the *Amendment Application* lacked sufficient information to verify Swarm's vague

claims about "low power".[25] However, as demonstrated in the interference analysis provided in in ATTACHMENT 1, based on the mobile earth transmit power parameters indicated in the Swarm NVNG MSS Blanket Mobile Earth Station license issued under FCC Call Sign E190490, co-frequency Swarm uplink transmissions would clearly cause unacceptable interference to ORBCOMM uplink operations.

Similarly, Swarm's nebulous reference to potential use of inter-system time-division multiple access (TDMA) also fails to provide any assurance whatsoever that use of this technique could viably facilitate co-frequency sharing without causing unacceptable interference to ORBCOMM's operations. Instead, the idea of trying to use inter-system TDMA as a sharing solution raises a host of unanswered questions without any obvious answers.[26] Use of a TDMA scheme for inter-system sharing would require an extremely complex and likely unachievable level of real-time coordination among all of the entities that utilize the NVNG MSS uplink, including the terrestrial fixed and mobile service users. Moreover, such a solution would require ORBCOMM to significantly re-engineer its system. The Commission's Rules specify in Section 25.142(b)(3) with regard to the cooperation obligations of incumbent NVNG MSS licensees that "the permittee or licensee being coordinated with is not obligated to suggest changes or re-engineer an applicant's proposal in cases involving conflicts." *A fortiori*, an incumbent licensee re-engineering its own system should not be required, either.

Swarm's final proposed possible sharing technique – geographic sharing – would require ORBCOMM to cede its first-in-time license rights. Furthermore, attempting to implement inter-

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[25] *ORBCOMM Petition*, at p. 9.

[26] What organization will establish and enforce the TDMA schedule? As capacity demands grow, what organization will determine what entity has priority? What clock will be used? How will conflicts be resolved? And there are many more questions that would need to be addressed.

system NVNG MSS geographic sharing would more likely than not prove ineffectual or impractical. Among other things, the idea of geographic sharing between NVNG MSS systems raises very similar issues as trying to share using inter-system TDMA with regard to real-time allocation of the resources, including how such adjustments might be made, and who determines priority. In addition, inter-system co-frequency sharing by geographic separation of mobile earth stations would require some new unprecedented form of mobile earth station geo-fencing. A "solution" that would appear to be difficult if not impossible to implement successfully without some attendant use of band segmentation (which would require ORBCOMM ceding its first-in-time license rights).

Swarm also complains that ORBCOMM only just now raised concerns about their proposed downlink operations causing interference, and did not raise any objections to the downlinks with respect to its initial application.[27] Swarm's response somehow ignores the fact that the *Amendment Application* proposed a completely different downlink frequency plan for the Swarm system. The simple answer is that in the initial application, Swarm only requested authority to operate on downlink spectrum in the 137-138 MHz band on specific channels that did not overlap with frequencies on which ORBCOMM conducts downlink transmissions. In contrast, in the *Amendment Application* Swarm now proposes to operate downlinks throughout the 137-138 MHz band.[28] But the *Amendment Application* attempted to make no demonstration

[27] *Swarm Opposition* at p. 12.

[28] *Amendment Application* at Table 1 and Table 4.

whatsoever as to how Swarm could implement its proposed modification of its downlink operations without causing unacceptable interference to ORBCOMM's downlink operations.[29]

Swarm's vague references to potential sharing techniques and unsubstantiated assertions that it will be able to coordinate any problems also ignores the complexities of sharing the uplink band, which is heavily congested with terrestrial service usage that cannot be disrupted by NVNG, and which is subject to NVNG MSS operating constraints (including duty cycle and channel agility requirements) that make intra-system NVNG MSS sharing even more difficult. Furthermore, the Swarm request for waiver of US323 and its use of much wider uplink channels (by a factor of up to 50) only further complicates sharing with ORBCOMM. Given the inadequacies of Swarm's submissions, but based on what the record reflects regarding Swarm's proposed operations and the *significant* congestion of the 148–149.9 MHz portion of the NVNG MSS uplink band due to terrestrial service usage, the only way that ORBCOMM could coordinate uplink sharing with Swarm under their current proposed system design would be by band segmentation of some form. The simple fact is that Swarm has not identified any other reasonable or reliable means of protecting ORBCOMM's uplink operations from unacceptable interference. Such an outcome would be inefficient and contrary to the Commission's spectrum policies, but would also seemingly be unnecessary. Swarm has identified no new services in its *Amendment Application* that were not identified in its initial application,[30] and the Commission has already authorized Swarm for all the spectrum Swarm requested in its initial application

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[29] The only discussion of downlink sharing was with respect to the NOAA satellites. *Amendment Application* at pp 29-30.

[30] Indeed, the *Amendment Application* at p. 11 states that "The basic description of Swarm's operations and services will not change as a result of the modifications proposed in this amendment."

(granted a mere seven months before it filed the *Amendment Application*). ORBCOMM should not be made to suffer unacceptable interference just because Swarm's constellation design and/or business plan apparently became obsolete or not otherwise possible to implement even before deployment occurred.

In sum, the little information that was provided by Swarm in the *Amendment Application* and the *Swarm Opposition* fail to demonstrate that Swarm will not cause unacceptable interference to the ORBCOMM system, and in fact suggest that such interference would in fact occur. Of course, as ORBCOMM indicated in response to Swarm's initial application[31] and repeated in the *ORBCOMM Petition*,[32] ORBCOMM stands ready to fulfill its obligation under the Section 25.142(b)(3) of the Commission's Rules to "cooperate fully and make every reasonable effort to resolve technical problems and conflicts that may inhibit effective and efficient use of the radio spectrum."

Swarm is simply wrong in asserting that it "has attempted to coordinate with an increasingly defiant ORBCOMM for about two years."[33] Swarm did contact ORBCOMM with respect to some of its FCC Part 5 Experimental license applications, and ORBCOMM responded accordingly in the Commission's record of those applications.[34] ***However, despite ORBOMM's repeated statements on the record that it stands ready to work with Swarm, Swarm has never***

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[31] ORBCOMM Petition to Dismiss, Deny or Hold in Abeyance, Filed April 1, 2019 at p. 6 ("ORBCOMM stands ready to coordinate in good faith.").

[32] *ORBCOMM Petition*, at p. 7.

[33] *Swarm Opposition* at p. 12.

[34] *E.g.*, ORBCOMM Response - FCC Part 5 Application File No. 0976-EX-ST-2018 Swarm Technologies, Inc., sent August 2, 2018.

contacted ORBCOMM prior to or after filing any of its Part 25 applications with respect to addressing or resolving any matters relating to spectrum utilization or inter-system sharing.

To the contrary, and notwithstanding the Commission's Rules encouraging such action, regarding the Part 25 Swarm applications filed prior to the *Amendment Application*, Swarm claimed that it did not need to contact ORBCOMM regarding Swarm's proposed frequency utilization because it was not proposing to operate in any spectrum in which ORBCOMM is entitled to interference protection.[35] Additionally, Swarm has never contacted ORBCOMM regarding its *Amendment Application*, notwithstanding (i) that the Commission's Rules encourage such efforts, (ii) the fact that unlike the initial application Swarm unambiguously would be overlapping with ORBCOMM's spectrum, and (iii) that ORBCOMM had previously expressed its willingness to engage in such discussions. ORBCOMM's actions are far from being "increasingly defiant." Nor does ORBCOMM believe that such efforts would prove fruitless. ORBCOMM believes that Swarm might be able to devise a viable means for modifying its proposed system by, among other things, incorporating effective active interference avoidance technology that can reliably facilitate shared service area, real-time co-frequency sharing of MES uplink spectrum between ORBCOMM and Swarm in accordance with ORBCOMM's first-in-time license rights. The successful pre-licensing agreement to share spectrum in this manner mutually entered into by three narrowband FDMA system applicants in the *Second Processing Round* certainly indicates that this should be possible. However, as demonstrated in the *ORBCOMM Petition*, and as further

[35] *E.g.*, Swarm Opposition filed April 15, 2019 at p. 2 ("Along the same lines, ORBCOMM disputes whether Swarm has sufficiently explained how it plans to coordinate operations. But Swarm did not apply to operate in any band segments in which ORBCOMM can claim a right to protection from harmful interference.").

discussed in this submission, Swarm's user terminal-based CSMA/CA active interference avoidance system as currently architected is fatally flawed, as are the other vague "sharing techniques" proffered thus far by Swarm.

In light of Swarm's failure to include the demonstration required by Section 25.142(a)(1) and the paucity of the relevant information in its applications with regard to the technical characteristics relevant to its sharing capabilities, ORBCOMM finds it ironic that Swarm would demand information of Myriota.[36] However, ORBCOMM's willingness to cooperate as an existing NVNG MSS licensee, consistent with 25.142(b)(3), cannot and should not be misconstrued as ORBCOMM consenting to being an *applicant* in the current processing round. It is not clear whether ORBCOMM's cooperation would be more efficient on a bilateral or multilateral basis, but ORBCOMM is willing to work with Swarm and Myriota in a manner that all the applicants and the Commission believes would work best.[37] Any such good faith efforts by ORBCOMM would under no circumstances include forfeiting our first-in-time priority rights, and contrary to the "creative" (*i.e.*, preposterous) suggestion in the *Swarm Opposition,* the Commission's Rules and policies provide no mechanism for voiding ORBCOMM's license

[36] *Swarm Opposition* at pp. 19-21.

[37] Comments of Myriota Pty. Ltd., filed August 17, 2020 at p. 6 ("Swarm should be required to coordinate with Myriota, and ORBCOMM should be required to coordinate with both Myriota and Swarm, in order to implement a new sharing plan in the NVNG VHF Bands."). Unlike Swarm, Myriota recognizes ORBCOMM's priority rights to the spectrum by proposing to only use ORBCOMM's primary spectrum when the ORBCOMM satellites are not in view of the Myriota terminals. (See p. 5 of their Attachment A – Technical Description in SAT-PDR-20191118-00135).

rights by involuntarily designating ORBCOMM – a non-applicant -- as a party to the processing round.[38]

Waiver of US323 is not Warranted

The *ORBCOMM Petition* explained why Swarm's requested waiver of US323 failed to meet the legal standards.[39] In support of its waiver request, Swarm claims that it will allow Swarm to "expand and diversify the services supported by the Swarm system."[40] However, Swarm identified no additional services in the *Amendment Application* that it had not claimed it would already be able to offer in its initial application, which the Commission granted in full a mere seven months before Swarm filed the *Amendment Application*.

In defense of its waiver request, Swarm makes two arguments – that ORBCOMM was not the intended beneficiary of the rule, and that ORBCOMM would not be adversely impacted.[41] While originally US323 was designed to protect the federal terrestrial services, the operating constraints set forth in US323 were also inherently integral to the inter-system NVNG MSS sharing arrangements that were incorporated into the Commission's Rules during the Second Processing Round to allow multiple FDMA systems to share the limited uplink bands. Thus, the "purpose" of the Rules has evolved. Moreover, one of the standards for grant of a waiver is that grant of the waiver must not undermine the public interest policy served by the

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38 *Cf.*, n. 17, *supra*.

39 *ORBCOMM Petition*, at pp. 14-15.

40 *Swarm Opposition* at pp. 17.

41 *Swarm Opposition* at pp. 18-19.

rule[42] -- and in this case that public interest policy is preventing harmful interference. Even more importantly, contrary to Swarm's unsupported assertions, as demonstrated above, there is an even greater likelihood of unacceptable interference to ORBCOMM that would result from Swarm's longer and more frequent transmissions if the waiver is granted.[43] Thus, it would disserve the public interest to allow Swarm to operate without complying with the US323 limits in any spectrum shared with ORBCOMM.

As explained in the *ORBCOMM Petition*, to the extent the federal users' protection needs have changed, then a rulemaking would be the proper procedural mechanism to address how all the affected NVNG MSS systems should be permitted to operate in a manner that takes account of those changed circumstances.[44] Allowing Swarm alone to benefit from the ability to provide more robust services on a less-constrained basis as per the waiver requested in the *Amendment Application* would not only increase the severity of unacceptable co-frequency interference to ORBCOMM, it would also provide Swarm with an unfair and undeserved competitive marketplace advantage over ORBCOMM or any other NVNG MSS licensee. For all of these reasons, Swarm's requested waiver of US323 should be denied, and the Commission should

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[42] *WAIT Radio v. FCC*, 418 F.2d 1153, 1157 (D.C. Cir. 1969)(even though the overall objectives of a general rule have been adjudged to be in the public interest, it is possible that application of the rule to a specific case may not serve the public interest if an applicant's proposal does not undermine the public interest policy served by the rule). *See, also*, *Northeast Cellular Telephone Co. v. FCC*, 897 F.2d 1164, 1166 (D.C. Cir. 1990) (stating that in granting a waiver, an agency must explain why deviation from the general rule better serves the public interest than would strict adherence to the rule).

[43] See p. 14, *supra*. It is also disingenuous for Swarm to characterize a nearly four-fold increase in the transmission duration as being "slightly extended." *Swarm Opposition* at p. 18.

[44] *ORBCOMM Petition*, at pp. 14-15.

consider commencing a rulemaking to consider modifications of US323 applicable to all NVNG MSS licensees.

Correcting the Record with Regard to Swarm's Numerous Mischaracterizations

The Commission's Rules are clear with regard to Swarm's obligation to demonstrate in its application how it will avoid causing harmful interference to ORBCOMM's prior-licensed NVNG MSS operations. And, as ORBCOMM also showed above (and in the *ORBCOMM Petition*), Swarm failed to meet that obligation. Presumably recognizing this, Swarm made a number of claims with regard to ORBCOMM that are inaccurate and irrelevant in an attempt to compensate for its absence of the required demonstration. While distracting the audience may work as a ploy for magicians and mountebanks, the Commission should not permit it to work as an approach to fulfilling regulatory obligations. Nevertheless, ORBCOMM feels compelled to correct the record with regard to several unsupportable assertions in the *Swarm Opposition*.

Swarm's claims that ORBCOMM is an "outdated monopolist" ring hollow.[45] For many years, ORBCOMM has successfully faced increasingly significant worldwide competition from numerous other well-established terrestrial and satellite service providers. Swarm claims to be poised to enter the market, and was licensed for all of the spectrum it asked for in its initial application, which was granted seven months before it filed the *Amendment Application*. ORBCOMM welcomes competition, and is fully prepared for any marketplace challenge that Swarm may pose if it is ever successful in its ambitious aspirations. ORBCOMM is anything but a monopolist, nor is it acting like one. Indeed, as recognized by Swarm, ORBCOMM has only

[45] *Swarm Opposition* at pp. 3 and 12.

legitimately raised concerns about Swarm's planned operations when Swarm proposes to do so in a manner that is likely to cause unacceptable interference to ORBCOMM.[46]

Swarm also mischaracterizes ORBCOMM's actions in Europe,[47] which demonstrates either ignorance of applicable international law and regulation, or a contrived disregard for it. Far from adopting a global spectrum sharing plan for NVNG MSS, the Commission explicitly recognized in adopting both the initial NVNG MSS service Rules and the Second Processing Round Rules that foreign authorities have exclusive jurisdiction to determine how satellite uplink sharing would occur within their territories.[48] The terrestrial sharing environment and regulatory

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[46] *Swarm Opposition* at p. 6 (ORBCOMM raised no objections to the proposed changes in orbital parameters and propulsion capabilities), and *Swarm Opposition* at p 12 (ORBCOMM raised no objections in the initial application to the downlinks).

[47] *Swarm Opposition* at pp. 15-16.

[48] *In the Matter of Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Non-Voice, Non-Geostationary Mobile-Satellite Service*, 8 FCC Rcd 8450 (1993) at ¶ 28 ("Because we will require our licensees to comply with international procedures, including the national requirements of any other licensing administrations, the efforts of these other jurisdictions to implement NVNG service within their own territories will remain within their control."); and *ibid*. at n. 3 ("In order to provide global service, a Little LEO service provider will need to receive authorization or approval from each country in which it intends to offer Little LEO service."). See, also, *In the Matter of Amendment of Part 25 of the Commission's Rules to Establish Rules and Policies Pertaining to the Second Processing Round of the Non-Voice, Non-Geostationary Mobile Satellite Service*, 13 FCC Rcd. 9111 (1997), at ¶ 128:

> In opposition, CTA argues that Little LEO licensees should not be penalized for the limited availability of spectrum by foregoing commercial opportunities in countries where spectrum may be extremely limited. Our intent is not to penalize licensees and we do not believe that our policy will have such a result. We recognize that spectrum coordination and availability as well as market size and commercial opportunities in a particular country may limit the number of systems that can serve that country. We will not penalize the sole service provider in a particular market if spectrum and market limitations prohibit another system from entering and serving the particular market. We do not expect a United States licensed system to forego opportunities to serve markets based on the possibility that it may be the only service provider in the market. (citation

structure for mobile satellite service market entry in Europe differs from that in the United States, and the Commission recognizes that the European Administrations have the knowledge, expertise and sovereignty to address how such entry and spectrum sharing should occur within their borders.

Swarm also mischaracterizes ORBCOMM's satellite system operations, based on taking some of the company's disclosures to investors incorrectly or out of context, or relying on speculative articles. Of course, as noted above, Swarm never took up ORBCOMM's offer to engage in sharing discussions, which could have corrected the misunderstandings under which Swarm seems to labor.

While Swarm is correct to note that the ORBCOMM system currently operates below full capacity, Swarm completely and blatantly mischaracterize statements during earnings calls by ORBCOMM's CEO and cautionary language in ORBCOMM's Securities and Exchange Commission filings that must necessarily be very conservative.[49] For example Swarm's cites language from ORBCOMM's 2019 10-K SEC filing regarding use of two channels,[50] but that discussion was addressing downlinks, not uplinks. In fact, each second-generation ORBCOMM satellite today can receive traffic on 48 simultaneous uplink channels, with frequent channel changes in order to maintain compliance with the US323 operating restrictions and other

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omitted)

Thus, Swarm's citation to NGSO FSS or Big LEO decisions in footnote 56 of the *Swarm Opposition* is misplaced.

[49] *Swarm Opposition* at pp. 9-10.

[50] *Swarm Opposition* at p. 3.

regulatory obligations. When more than one ORBCOMM satellite is in view, these numbers are multiplied accordingly.

The ORBCOMM CEO's discussion of "excess capacity" cited by Swarm refers to ORBCOMM's ability to surge resources in high-demand areas, a capability which is used sparingly and involves the simultaneous use of more than the two—up to six—downlink channels.[51] Because each downlink channel requires some dedicated uplink capacity, such surges can require reorganization of traffic and can require delays of some messages beyond what is normally experienced. ORBCOMM operations personnel and automated systems constantly monitor network performance and can adjust the available resources as required. Building flexibility and an ability to address spikes in demand into the ORBCOMM satellite system is hardly a sign of inefficiency.

Likewise, Swarm mistakenly makes the claim that, because the ORBCOMM system's full capacity is not in use, and because the network was able to sustain its performance despite some satellite losses, ORBCOMM is an inefficient user of the frequency band.[52] Far from it. Rather, it is an indication that ORBCOMM has been particularly diligent in protecting its customers and its investors, building satellites that were more capable than needed to support the network to protect its stakeholders against unforeseen circumstances and future growth, all while operating in a challenging satellite uplink sharing environment in a band with significant congestion resulting from fixed and mobile service system usage. Building in such resiliency and robust capabilities does not make ORBCOMM an inefficient user of spectrum – it does exactly the opposite.

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[51] *Swarm Opposition* at p. 4.

[52] *Swarm Opposition* at p. 10.

In sum, the Commission should ignore Swarm's inflammatory and inaccurate rhetoric, and instead focus on the simple fact that Swarm has failed to submit any credible demonstration that it will not cause unacceptable interference to ORBCOMM, as specifically required by the NVNG MSS space segment licensing application Rules. On that basis alone, the Commission should either compel Swarm to amend its modification application accordingly, or dismiss or deny the *Amendment Application* as patently defective.

Respectfully submitted,

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September 14, 2020

ATTACHMENT 1

ANALYSIS OF CO-FREQUENCY INTERFERENCE
SWARM MES UPLINK to ORBCOMM SATELLITE RECEIVER
(See Explanatory Note)

ORBCOMM VICTIM UPLINK RX PARAMETERS		
Satellite Altitude	715	km
Elevation	5	degrees
Received Signal (incl implementation losses)	-117	dBm
Total Rx Noise density	-167	dBm/Hz
Noise Power (2.4KHz)	-133.2	dBm
Eb/N0	16.2	
Margin	5.1	dB

CO-FREQUENCY INTERFERENCE TO ORBCOMM UPLINK RX FROM SWARM MES UPLINK

	Swarm 7.8 kHz TX Chnl			Swarm 250 kHz TX Chnl		
ORBCOMM Sat RX/Swarm MES Elevation (°)	5	40	90	5	40	90
Swarm MES TX power (W)	5	5	5	5	5	5
Swarm MES TX Antenna Gain (dBi)	2.5	0	-5	2.5	0	-5
Swarm MES EIRP (dBW)	9.5	7	2	9.5	7	2
Swarm MES TX BW (kHz)	7.8	7.8	7.8	250	250	250
Swarm MES TX EIRP Density (dBW/4 kHz)	6.6	4.1	-0.9	-8.5	-11	-16
Path Loss (dB) - Friis Formula	-144.2	-136.3	-133	-144.2	-136.3	-133
Satellite Rx Antenna Gain (dBi)	1.5	-3	-8.5	1.5	-3	-8.5
Polarization Loss (dB)	3	3	3	3	3	3
Interferer Level (dBm/4 kHz)	-109.1	-108.2	-115.4	-124.2	-123.3	-130.5
Interferer Level (dBm / 2.4 kHz)	-111.3	-110.4	-117.6	-126.4	-125.5	-132.7
Degraded ORBCOMM Eb/N0	**-5.7**	**-6.6**	**0.5**	**8.6**	**7.8**	**12.9**
Resulting ORBCOMM Uplink RX Margin	**-16.8**	**-17.7**	**-10.6**	**-2.5**	**-3.3**	**1.8**

ATTACHMENT 1 Explanatory Note: Swarm MES antenna gain mask parameters by elevation angle are not included in the *Amendment Application* or the Swarm NVNG MSS Blanket Mobile Earth Station license issued under FCC Call Sign E190490. For this analysis, these parameters are assumed based on a typical VHF user terminal antenna gain mask with the Tx mainbeam oriented towards ground horizon. These assumed parameters may understate the potential interference because they result in Swarm TX gain mask levels that are lower than maximum gain parameters provided in Swarm FCC filings, which in turn may understate to the potential interference power and resulting interference to ORBCOMM.

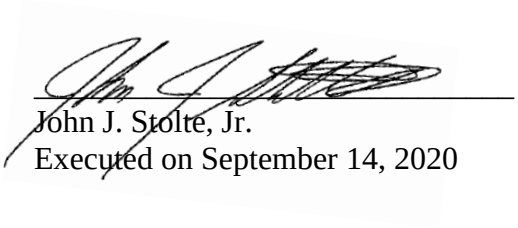
DECLARATION

I, John J. Stolte, Jr., hereby declare as follows:

1. I am Executive Vice-President of Technology and Operations at ORBCOMM Inc.

2. I have reviewed the foregoing Reply of ORBCOMM License Corp. (the "Reply").

3. I declare under penalty of perjury that the facts set forth in the foregoing Reply (except for those of which official notice may be taken) to support the specific relief requested are true and correct to the best of my knowledge, information and belief.



John J. Stolte, Jr.
Executed on September 14, 2020

CERTIFICATE OF SERVICE

I hereby certify that on this 14th day of September, 2020, I caused a true and correct copy of the foregoing "REPLY OF ORBCOMM LICENSE CORP." to be sent by first class mail, postage prepaid, and email to the following:

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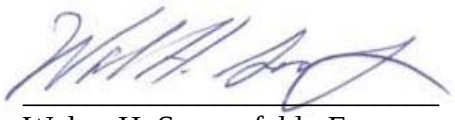

Walter H. Sonnenfeldt, Esq.