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

Application of	)	
MYRIOTA PTY. LTD.	)	File No. _____
Petition for Declaratory Ruling Granting Access to the U.S. Market for Non-Voice, Non-Geostationary Satellite System	)	Call Sign _____

PETITION FOR DECLARATORY RULING

Myriota Pty. Ltd. ("Myriota"), pursuant to Section 25.137 of the Commission's rules,[1] submits this Petition for Declaratory Ruling ("PDR") requesting access to the U.S. market for Myriota's planned non-voice, non-geostationary orbit ("NVNG") Mobile-Satellite Service ("MSS") system. Myriota's network of small satellites will communicate with low-power NVNG modules and employ advanced signal processing to provide connectivity to a new generation of Internet of Things ("IoT") devices. As demonstrated in this PDR and the accompanying materials,[2] Myriota is legally, technically, and otherwise qualified; its proposed facilities and operations comply with all applicable rules, regulations, and policies; and grant of this PDR will serve the public interest, convenience, and necessity. Accordingly, the Commission should grant the PDR expeditiously.

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1 47 C.F.R. § 25.137.

2 A completed Form 312, accompanying Schedule S, Technical Attachment, and Waiver Request are associated with this application, consistent with the information required by the Commission's rules in support of the requested authorization.

I. INTRODUCTION AND BACKGROUND

A. Myriota Will Provide Low-Cost, Spectrum Efficient Connectivity for IoT Devices Worldwide

Myriota is a private Australian company founded in 2015 to commercialize breakthrough communications technology developed during a three-year research project at the University of South Australia. Myriota enables secure low-cost communications for IoT devices anywhere on the planet using patented techniques for massive scale direct-to-orbit communications. Myriota will deliver global coverage by transmitting directly from and to satellites in low-Earth orbit ("LEO"), which removes the need for almost all ground-based infrastructure.

Myriota has overcome significant technical challenges to realize this direct-to-orbit capability, as follows:

- **Long communications range**: Myriota's communications receiver employs powerful synchronization and error correction to ensure that messages are correctly received, even at low elevation with link distances greater than 2,000 km.
- **Massive multiuser communications**: The field of view of a LEO satellite is around 5,000 km in diameter and may contain millions of devices. Myriota's communications receiver is able to synchronize and decode messages from a massive number of devices at once even when these messages substantially overlap each other in time and frequency. This provides highly efficient use of spectrum.
- **Long battery life**: Myriota connected devices have multi-year battery life. Myriota enables this by using radio waveforms designed for reliable low power transmission; intelligent transmit scheduling algorithms; and low energy IoT electronics.
- **Security**: Myriota provides encrypted and authenticated access via AES-GCM-256, with unique per-module keys, while also providing secure private device identity.

The ability to provide such ubiquitous, low-cost, spectrum-efficient connectivity for IoT devices will support a wide range of applications, including:

- **Environment**: Weather monitoring; water flow sensing; oceanography; soil monitoring; natural resource management.

- **Agriculture**: Water security and irrigation; livestock tracking; sensor telemetry; soil moisture probes; weather stations; logistics & asset management; preventative maintenance; infrastructure monitoring; fuel stores.

- **Resource sector**: Asset tracking and monitoring; equipment inventory and tracing; predictive maintenance; process optimization.

- **Utilities**: Smart grid; meter reading; infrastructure management; remote alerts and control.

- **Transport and Logistics**: Asset tracking and monitoring; end-to-end freight; route planning and optimization; intelligent transport.

Myriota is already delivering its direct-to-orbit IoT service commercially in Australia using satellites owned by Canadian operator exactEarth. Customers span a range of government and industry sectors including agriculture, defense, environmental management, asset management, and maritime. Myriota-enabled deployments have been active in Australia for more than 18 months, and over 250,000 messages have been delivered to customers. These customers are leveraging Myriota's module and developer toolkit hardware and software, now in its second generation, to open new markets for their products.

In addition, Myriota is using a payload on the BRIO satellite, launched in December 2018 by U.S. satellite provider SpaceQuest,[3] to validate Myriota's next generation software-defined radio technology, including advanced on-orbit signal processing, firmware upgradability, and link budgets, in preparation for deployment of Myriota's next generation satellites. The system proposed in this application will enable Myriota to take the next step in developing and deploying its NVNG network, with the launch of its first three satellites currently anticipated by the end of this year.

[3] *See* Experimental License File Number 0220-EX-CN-2018.

B. The Proposed NVNG System

Myriota will operate its NVNG system in the United States using the 399.9-400.05 MHz (Earth-to-space) and 400.15-401 MHz (space-to-Earth) frequency bands. Both bands have been allocated to non-Federal MSS on a primary basis and are specifically identified as being available for NVNG MSS operations.[4] Myriota can configure the length, interval, data rate, bandwidth, and frequency of transmissions from satellites and earth stations in its system. The various space and ground facilities composing the Myriota system are described below and in more detail in Schedule S and the Technical Attachment (Attachment A) accompanying this application.

1. Space Segment

The Myriota system will consist of 26 LEO satellites operating in 18 planes that target an initial altitude of no greater than 600 km,[5] with orbital inclination at either 97.7 degrees (sun synchronous) or 54 degrees. The satellites will circle the Earth approximately every 97 minutes. Its first generation of satellites will not have active propulsion, but collision avoidance maneuvers will be trialed using differential drag techniques to characterize differential drag maneuvering. The upgraded generation of satellites will have propulsion capability to enable in-orbit maneuvers for constellation station keeping, and to avoid potential collisions.[6] In either case, Myriota satellites will utilize disposal via atmospheric re-entry in less than 25 years from deployment. The

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[4] *See* 47 C.F.R. §§ 2.106, 25.202(a)(3). *See also* 47 C.F.R. § 2.106 n.US320 (the use of the 399.9-400.05 MHz and 400.15-401 MHz bands by the MSS is limited to NVNG satellite systems).

[5] Ideally, Myriota would deploy all of its satellites at a 600 km altitude. However, in some cases, these satellites may be secondary rideshare payloads and therefore somewhat subject to initial orbital parameters dictated by launch providers. Accordingly, Myriota requests authority to deploy and subsequently replenish its constellation on launches with parameters within inclinations from equatorial to polar, and apogee and perigee from 400-600 km.

[6] Myriota also seeks authority to communicate with technically identical follow-on satellites launched to replenish its constellation as satellites reach end of life, in order to ensure continued operations.

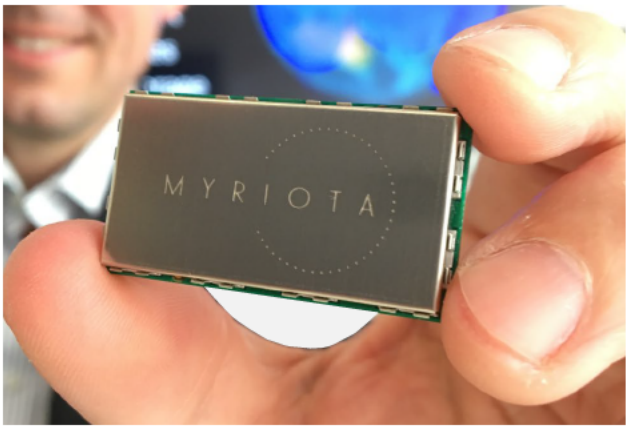
minimum operational altitude at which Myriota satellites will be used for commercial transmissions will be approximately 400 km. The nominal operational lifetime of a Myriota satellite is between three and five years, with an orbital lifetime not exceeding 25 years from launch, consistent with the international standard. No spacecraft components are expected to survive re-entry or reach the Earth's surface.

Myriota will operate its constellation under an International Telecommunication Union ("ITU") filing made by Australia for the "MNSAT" satellite network, which is currently submitted for coordination. Myriota requests authority to communicate with follow-on satellites launched to replenish its constellation as satellites reach end of life, as necessary, to maintain its on-orbit fleet of 26 satellites.

2. Ground Segment

The Myriota system includes three broad categories of earth stations:

- **IoT modules** (see picture below) provide Myriota's advanced nanosatellite transceiver for secure data transfer and a system for sophisticated power management. They allow Original Equipment Manufacturers to add global IoT connectivity and reliable, long battery life to their devices for a wide range of mobile applications.



- **International ground stations** backhaul data to and from the NVNG constellation to provide connectivity to the Internet, and also perform telemetry, tracking, and control ("TT&C") functions.
- Low-cost **micro-gateways** also backhaul data to and from the NVNG constellation, augmenting the international ground station network and providing low latency in-country connectivity to the Internet. Each micro-gateway includes a Myriota radio for nanosatellite connectivity which operates at low transmit power.

Myriota seeks access to the U.S. market only for communications with IoT modules and micro-gateways, as the international ground stations will be operated in other countries. As appropriate, Myriota and/or its partners will submit applications to the Commission requesting blanket licenses for earth station operations in the United States, pursuant to Sections 25.115 and 25.130 of the Commission's rules.[7]

3. System architecture

Myriota's system architecture and data flow is illustrated in Figures 1 and 2 below.

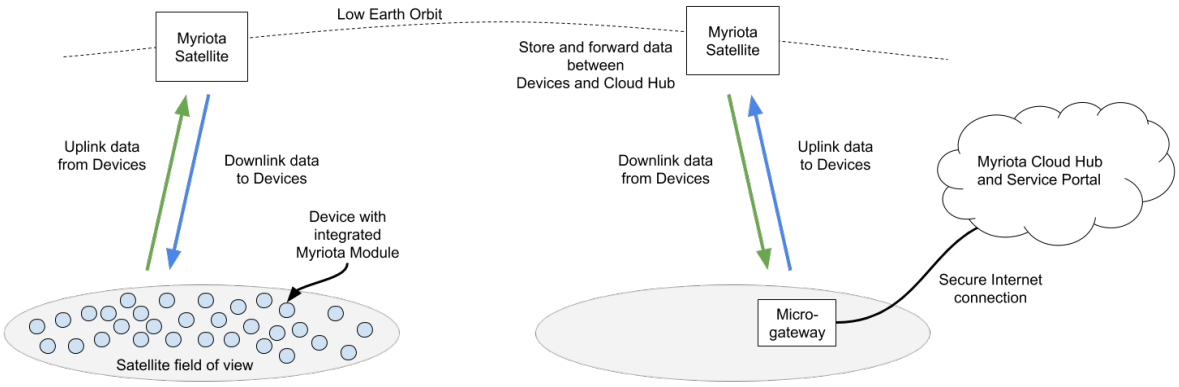


Figure 1. Myriota System Architecture Within U.S.

[7] *See* 47 C.F.R. §§ 25.115, 25.130.

Figure 1 shows the communication pathways between IoT devices and micro-gateway earth stations in the U.S. Data from IoT devices is uplinked to a Myriota satellite that passes within range. The satellite captures signals from large populations of devices, each having an integrated Myriota module. Myriota's advanced multiuser receiver decodes these signals, simultaneously providing access to massive numbers of devices. The receiver allows the module to transmit open-loop, *i.e.,* without the need for instruction from the satellite. Decoded data is stored on the satellite until it can be forwarded to a micro-gateway for delivery to Myriota's cloud-based hub over a secure Internet connection, and ultimately delivered to a cloud-based service portal that can be accessed by Myriota customers. Conversely, data from the service portal can be uplinked to a satellite via the cloud-based hub for later delivery, allowing customers to push data to their IoT devices in the field.

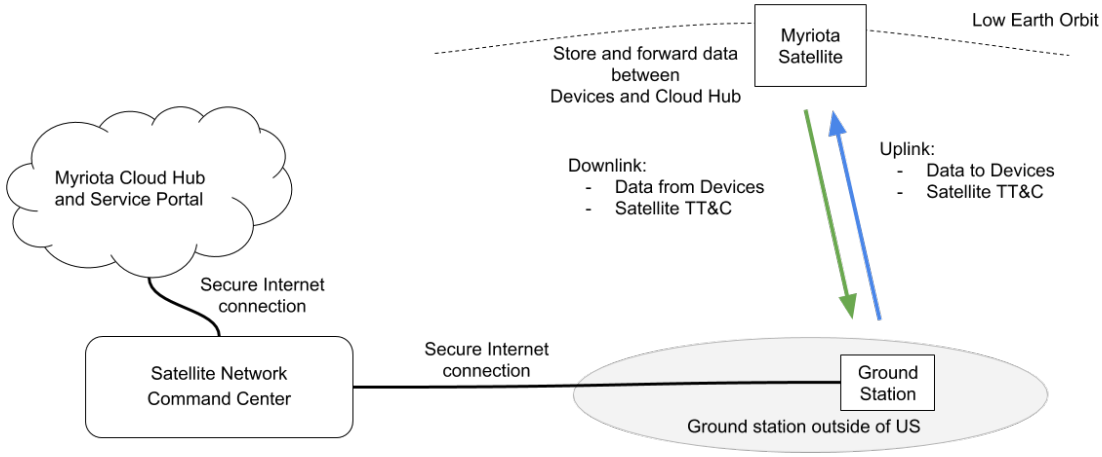


Figure 2. Myriota International Ground Station Architecture

Figure 2 shows how Myriota satellites communicates with the international ground station network that operates outside of the U.S. Like the micro-gateways discussed above, these ground stations have the ability to receive data from and transmit data to IoT devices via the satellites. However, they also provide the link used for TT&C functions. Myriota has contracted with Tyvak

Nanosatellite Systems Inc. ("Tyvak") to coordinate operations of the Myriota NVNG system from Tyvak's satellite network command center in Irvine, California. Myriota will deliver commands to, and receive data from, the satellite network command center, which is connected to an international ground station network operated by a range of international partners. Data is fully encrypted between the satellite network command center and the spacecraft.

II. GRANT OF THIS PETITION WOULD SERVE THE PUBLIC INTEREST

According to one forecast, worldwide IoT spending will reach $745 billion in 2019, an increase of 15.4% over 2018, and will maintain a double-digit growth rate through 2022, at which point it will pass the $1 trillion mark.[8] Analysts predict that interest in the sort of remote monitoring involved with IoT devices will continue to rise quickly because it tends to be an easily integrated or standalone application.[9] Myriota's satellite network will support this growth by providing massive scale connectivity virtually anywhere on Earth. Moreover, as discussed above, the Myriota NVNG system will bring a range of innovative services to the IoT market, especially for those in areas underserved or completely unserved by terrestrial networks. It will do so in a low-cost, spectrum-efficient manner that can create new opportunities for individuals and businesses across the U.S. and around the world. Clearly, these new services and capabilities would benefit the American public.

In addition, the Commission has established a framework for considering requests for

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[8] *See* INTERNATIONAL DATA CORPORATION, *IDC Forecasts Worldwide Spending on the Internet of Things to Reach $745 Billion in 2019, Led by the Manufacturing, Consumer, Transportation, and Utilities Sectors* (Jan. 3, 2019), https://www.idc.com/getdoc.jsp?containerId=prUS44596319.

[9] *See* Ann Bosche, et al., *Unlocking Opportunities in the Internet of Things* at 2, 4, BAIN & CO., (2018), https://www.bain.com/contentassets/5aa3a678438846289af59f62e62a3456/bain_brief_unlocking_opportunities_in_the_internet_of_things.pdf.

non-U.S. licensed space stations to access the U.S. market. In order to be approved, the applicant must demonstrate that grant of its request would serve the public interest.[10] In making that public interest determination, the Commission considers: (1) the effect on competition in the United States; (2) spectrum availability; (3) national security, law enforcement, foreign policy, and trade considerations; and (4) eligibility and operational requirements.[11] We address each of these considerations below, and demonstrate that granting Myriota's PDR would serve the public interest.

A. Effect on Competition in the United States

An applicant seeking access to the U.S. market for a non-U.S. licensed satellite system is entitled to a presumption in favor of entry if it is licensed by a World Trade Organization ("WTO") member country to provide satellite services covered by the WTO Basic Telecommunications Agreement (the "WTO Agreement").[12] As noted above, Myriota's NVNG system will be authorized by Australia, a member of the WTO. In addition, Myriota seeks authority to provide only satellite services that are covered by the WTO Agreement.[13] Therefore, Myriota is entitled to a presumption that market entry for its NVNG satellite system will satisfy the competition component of the public interest analysis.[14] This presumption is further supported by the fact that

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[10] *See Amendment of the Commission's Regulatory Policies to Allow Non-U.S. Licensed Space Stations to Provide Domestic and International Satellite Service in the United States*, 12 FCC Rcd. 24094, ¶ 29 (1997) ("*DISCO II Order*), *on reconsideration*, 15 FCC Rcd. 7207, ¶ 5 (1999).

[11] *See id.*

[12] *See DISCO II Order*, ¶ 39.

[13] *See, e.g., id.*, ¶ 30 (noting that MSS is a WTO-covered service); *Globalstar Licensee LLC*, 26 FCC Rcd. 3948, ¶ 21 (IB 2011) ("the Commission adopted a policy that granting market entry for provision of FSS or MSS via satellites licensed by a WTO-member country will be presumed to be beneficial for competition in the United States"). Myriota does not seek authority to provide direct-to-home, Digital Audio Radio Service, or Direct Broadcast Satellite Service in the United States.

[14] Accordingly, Myriota is not required to make an effective competitive opportunities showing. *See* 47 C.F.R. § 25.137(a)(2).

Myriota, a new MSS entrant, will enhance competition by providing new and innovative services to the burgeoning market for IoT devices and connectivity.

B. Spectrum Availability

The Commission also considers spectrum availability as a factor in determining whether authorizing a foreign-licensed satellite system to serve the U.S. market is in the public interest.[15] In doing so, the Commission evaluates whether grant of access would create the potential for harmful interference with U.S.-licensed satellite and terrestrial systems.

As discussed above, Myriota proposes to operate its NVNG system in a manner consistent with the U.S. Table of Frequency Allocations. Moreover, it will comply with all applicable Commission and ITU technical limits and sharing requirements, including power flux-density provisions designed to protect terrestrial systems and time-sharing procedures adopted to protect Meteorological Satellite Systems operated by the Department of Defense.[16] Myriota recognizes that it must protect GSO satellite systems from harmful interference,[17] and will do so.

Myriota's system also has the flexibility and spectral efficiency to operate harmoniously with other NVNG systems in this band. For example, Myriota's satellites can vary the bandwidth of their emissions through on-board processing and organize their emissions to accommodate sharing arrangements with other users of the band. Myriota downlink transmissions can range in bandwidth anywhere between 10 and 80 kHz, and operate anywhere within the entire 850 kHz allocated to MSS, or within any portion thereof that may be assigned. They can employ frequency hopping to move throughout the assigned band, or operate with a defined channel plan, either using

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15 *See DISCO II Order*, ¶ 149.

16 *See* 47 C.F.R. §§ 2.106 n.5.264, 25.260.

17 *See id.* § 25.289.

multiple contiguous channels or a fragmented channel arrangement. These downlink communications will typically operate at 10% duty cycle, further decreasing their potential to cause interference.

In the uplink band, Myriota NVNG modules operate with less than 5 dBW EIRP. This would be within the limit currently proposed under Agenda Item 1.2 to be considered at the World Radio Conference later this year.[18] The majority of these transmitters will operate with a typical duty cycle less than 0.02%, and occasionally up to 0.5%, and employ frequency hopping across the intended band, with an emission bandwidth of just 2 kHz. These operating characteristics give Myriota the ability to share the entire 150 kHz range with other NVNG systems also operating in the 399.9-400.05 MHz band, as well as the ability to operate in any portion of the band to which it is assigned.

C. National Security, Law Enforcement, Foreign Policy, and Trade Issues

The Commission has stated that the issues of national security, law enforcement, foreign policy, and trade will be considered in evaluating requests for market access, but are likely to arise only in "rare circumstances."[19] Further, Commission policy is to defer to the expertise of the Executive Branch in identifying and interpreting issues of this nature.[20] Myriota's request for authority to access the U.S. market with its NVNG system raises no such issues. Thus, this element of the Commission's public interest analysis is satisfied as well.

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18 *See* FEDERAL COMMUNICATIONS COMMISSION, DOCUMENT WAC/086, DRAFT PROPOSALS PRESENTED AT MARCH 11TH, 2019 MEETING OF THE WORLD RADIOCOMMUNICATION CONFERENCE ADVISORY COMMITTEE, AGENDA ITEM 1.2 (2019).: to consider the in-band power limits for earth stations operating in the mobile-satellite service, meteorological-satellite-service, and Earth exploration-satellite service in the frequency bands 401-403 MHz and 399.9-400.05 MHz, in accordance with Resolution 765 (WRC-15).

19 *See DISCO II Order*, ¶ 180.

20 *Id.*

D. Eligibility and Operational Requirements

Under Section 25.137, applicants seeking U.S. market access for non-U.S. licensed satellite systems must provide the same information concerning legal and technical qualifications as is required of applicants for space station licenses issued by the Commission.[21] The information set forth in this narrative application, the supporting Technical Attachment, Schedule S, and the accompanying FCC Form 312 demonstrates compliance with these requirements. In addition, Myriota hereby confirms that it will comply with the following Part 25 rules that warrant special attention: (1) Myriota has no right that would run afoul of the prohibition in Section 25.142(d) of the Commission's rules,[22] nor will it acquire any such right in the future; (2) it will post a surety bond as required under Section 25.165 of the Commission's rules;[23] (3) it will comply with the Commission's milestone requirements under Section 25.164;[24] (4) it does not have any other application for an NGSO-like satellite system license on file with the Commission, or any other licensed-but-unbuilt NGSO-like system, in any frequency band involved in this application;[25] and (5) it will not provide voice services with its NVNG systems.[26]

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[21] *See* 47 C.F.R. 25.137. *See also Amendment of the Commission's Space Station Licensing Rules and Policies*, 18 FCC Rcd. 10760, ¶ 288 (2003).

[22] *See* 47 C.F.R. § 25.142(d) ("No license shall be granted to any applicant for a non-voice, non-geostationary mobile-satellite service system if that applicant, or any companies controlling or controlled by the applicant, shall acquire or enjoy any right, for the purpose of handling traffic to or from the United States, its territories or possessions, to construct or operate space segment or earth stations in the non-voice, non-geostationary mobile-satellite service, or to interchange traffic, which is denied to any other United States company by reason of any concession, contract, understanding, or working arrangement to which the licensee or any persons or companies controlling or controlled by the licensee are parties.").

[23] *See id.* § 25.165(a)(1).

[24] *See id.* § 25.164(b).

[25] *See id.* § 25.159(b).

[26] *See id.* § 25.142(b).

III. CONCLUSION

For the foregoing reasons, and for the reasons set forth in the accompanying materials, Myriota requests that the Commission find that granting the PDR such that the NVNG system proposed herein may access the U.S. market would serve the public interest, and issue such grant expeditiously.

Respectfully submitted,

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