A. The Proposed Program of Research and Experimentation

SpaceQuest, Ltd. ("SpaceQuest"), a U.S. corporation headquartered in Fairfax, Virginia, requests FCC experimental authorization to test and evaluate an advanced RF Transceiver developed by Myriota, a spin-off company from the University of South Australia. Myriota has designed a novel communications protocol that uses a Software Defined Radio (SDR) and advanced signal processing that allows very large numbers of low power signals from user terminals to be received on the same frequency channel. Myriota desires to evaluate the ability of this advanced radio to function in a space environment. If successful, this would bring a cost-effective data communication technology to a new class of users – those with operations that require direct-to-orbit access for small amounts of data from numerous low-power devices.

The primary objective of the mission is to investigate, identify and resolve potential technical and implementation issues with its advanced satellite SDR radio design. Another important objective is to demonstrate the ability to upload and run new firmware that can introduce new features to the SDR Radio after it is on orbit. The results of this three-phase experiment will: (1) demonstrate and validate the ability to uplink large numbers of messages to a satellite using a single channel, (2) demonstrate the ability to downlink messages to different ground devices on a single channel, and (3) implement Myriota's advanced signal processing algorithms on board a satellite to provide highly spectrally efficient bidirectional communications.

The requested UHF frequency assignment will be used for satellite telemetry, tracking and command (TT&C) and bidirectional communication with Myriota's ground based terminals. The S-Band assignment will be used to download selected mission data from the payload.

SpaceQuest will also test the effectiveness of a new VHF "backdoor" receiver that the company designed and built to receive executive commands and/or to reboot the satellite flight computer in the event of a system failure. SpaceQuest will test whether the receiver, with its low-cost design and reduced weight and power, has the ability to function in very small satellites. The technical challenge is to demonstrate in space that a small, low-power radio device can be used to command a spacecraft independent of its traditional TT&C radio equipment. The benefit to the small satellite community is to establish the ability to rescue a spacecraft in the event of a non-recoverable anomaly with an acceptable size, mass, power and cost.

Specifically, SpaceQuest requests FCC experimental authority to construct, launch and operate a low-Earth orbit 3U CubeSat, "BRIO", on an unprotected, non-interference basis using the space-to-Earth UHF downlink frequency band of 400.50-400.65 MHz and the UHF Earth-to-space uplink frequency band of 399.90-400.05 MHz for TT&C communications as well as for two-way data communication with multiple small low-power radio devices on the ground. The Earth-to-space frequency band of 145.90 to 145.94 will be used to evaluate the operation and performance of a backdoor command receiver.

A one MHz allocation in the space-to-Earth frequency band of 2200-2290 MHz will be used to downlink experimental test data to Earth Stations in Inuvik, Canada and Esrange, Sweden. A one MHz allocation in the Earth-to-space uplink frequency band of 2025-2110 MHz will be used to acknowledge the downlinks and to upload new firmware to the Myriota payload infrequently. There will be no transmissions in these bands to any S-Band stations in the United States.

SpaceQuest is manufacturing the BRIO satellite to evaluate the Myriota communications waveforms and firmware on board the experimental payload. SpaceQuest has extensive experience in the design and manufacture of microsatellite components, ground system hardware and software, spacecraft buses, and space operations. The 3U CubeSat is scheduled to be launched by Spaceflight on a SpaceX Falcon 9 rocket from Vandenberg Air Force Base in October 2018.

SpaceQuest has provided a 24-hour contact to the FCC for any interference issues that may arise (see Exhibit 2, Technical Information, Section 15).

B. The Specific Objectives Sought To Be Accomplished

- Validate all hardware elements of an SDR payload in low-Earth orbit
- Verify functionality of on-orbit firmware upgrade capability
- Characterize and de-risk SDR firmware implementation of an advanced signal processor
- Verify the performance of a highly spectrally efficient uplink multiuser receiver and associated system capacity benefits
- Validate the operation of an advanced satellite UHF communications system
- Confirm link budgets, and tune the operational parameters for the signal processing algorithms while operating on-orbit
- Confirm power and data rate design to close the link to a small remote receiver
- Evaluate and space-qualify a miniature low-power receiver that can provide satellite executive commands independent of the primary TT&C system.

C. How the program of experimentation has a reasonable promise of contribution to the development, extension, expansion, or utilization of the radio art, or is along line not already investigated.

Through this experimental program, SpaceQuest will be able to test and evaluate the effectiveness of Myriota's advanced satellite communications system. Myriota's goal is to develop a satellite-based data delivery system that can provide dramatically lower cost, improved battery life and increased access to large populations of devices via low-Earth orbiting satellites. Users that require data from remote areas beyond the reach of cellular networks will benefit from the flexibility and convenience of a simple system that works anywhere. Users will be able to access data via a Cloud-based data management system. Results of this program of experimentation will spur development of new applications and solutions for various asset classes including industrial, utility, agricultural and environmental project applications and will facilitate critical information exchange, providing new levels of executive control, personnel efficiency and customer service.

D. About SpaceQuest, Ltd.

SpaceQuest specializes in the design, development, integration and testing of advanced space and ground components for low-Earth orbit satellites. Over the years, the company has developed satellite components and microsats to support experimental and amateur payloads – including AMSAT, EduSat, SaudiSat, USAF Academy, NASA Marshall, Stanford University, Colorado University, among others. SpaceQuest constructed the first mobile satellite communications terminal to be carried to the North Pole by an Arctic expedition team. The terminal was used successfully to transmit two-way messages and digital photographs to SpaceQuest's satellite ground station in Fairfax, Virginia.

Among SpaceQuest's successful experimental efforts, were its work for Bigelow Aerospace, developing the designs and manufacturing the hardware for the Genesis Pathfinder experimental space habitat, and developing, integrating and launching the Team Encounter Flight One mission that demonstrated Solar Sail Technology.

Over the years, the company has provided payloads for experimental missions and tested cutting-edge wireless communication components that have resulted in the development of cost-effective, timely and reliable hardware and software products for the space industry.

E. Estimated Experiment Duration

Pursuant to Part 5 of the Commission's Rules (§ 5.71 License period), SpaceQuest respectfully requests approval for a 5-year license for this experimental program. Due to the long lead times required for spacecraft construction, consideration of SpaceQuest's requested frequencies is of paramount importance in the near term. However, due to the SpaceX launch schedule, the earliest date that SpaceQuest can begin this experimental program is in the third quarter of 2018. Thereafter, SpaceQuest will continue to operate the satellite through its expected lifetime of 5 years.

In summary, SpaceQuest respectfully requests the Commission to grant its application for launch and experimental operation authority as detailed herein. To the extent possible, SpaceQuest requests that expedited consideration of this Application will be given in order to ensure favorable authorization in advance of the scheduled October 2018 launch of the BRIO satellite.

Pursuant to the document *FCC-Guidance-DA-13-445A1*, SpaceQuest provides the following:

Requested grant date: Not later than August 15, 2018

Critical go/no go date relevant to the license: September 1, 2018