voxa 1001 26th Ave E • Seattle, WA 98112 • http://projectvoxa.com

Federal Communications Commission
Office of Engineering and Technology
Experimental Licensing Branch
445 12th St., S.W.
Room 7-A322
Washington, DC 20554

2020.03.19

Dear Sir or Madam:

This application is for FCC authorization for Voxa to operate Mochii Spectroscopic Scanning Electron Microscope's WiFi and Bluetooth radios aboard the International Space Station (ISS).

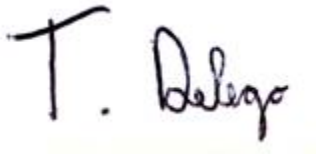
Mochii (pictured below, exhibit "external image of Mochii") is the world's first portable electron microscope (EM), and enables nanoscale imaging and analysis in field applications. Mochii will be used in ISS on orbit to perform novel science in space and support crew and vehicle safety by identifying invisible mission threats. It features an innovative model for collaborative science, allowing multiple scientists, stakeholders, and technicians to simultaneously view and contribute to live analyses. Being a portable, collaborative tool, it is configured for wireless communications to enable rapid data acquisition in the field.

Mochii, Inc. (DBA Voxa) has been working with NASA to certify Mochii for operation aboard the ISS. Mochii has undergone rigorous testing including EMI/EMC certification testing at Johnson Space Center. The flight-certified Mochii was flown up to ISS on the Northrop Grumman NG-13 commercial resupply mission on February 15th, 2020. Mochii will provide NASA the capability to analyze samples in on-orbit microgravity experimental conditions without having to send them back down to earth.

voxa 1610 N 170th St • Shoreline, WA 98133

Details of Mochii's wireless operation and configuration are included in this letter, and test and supporting data are appended to the application.

Sincerely,



Theodore DeRego
Software Engineer, Voxa

Included as exhibits in this application are photos of Mochii on Earth and its location on the ISS, and NASA's EMI (electromagnetic interference) test results for Mochii.

Experiment Description

The Mochii experimental platform on the ISS will test the following:

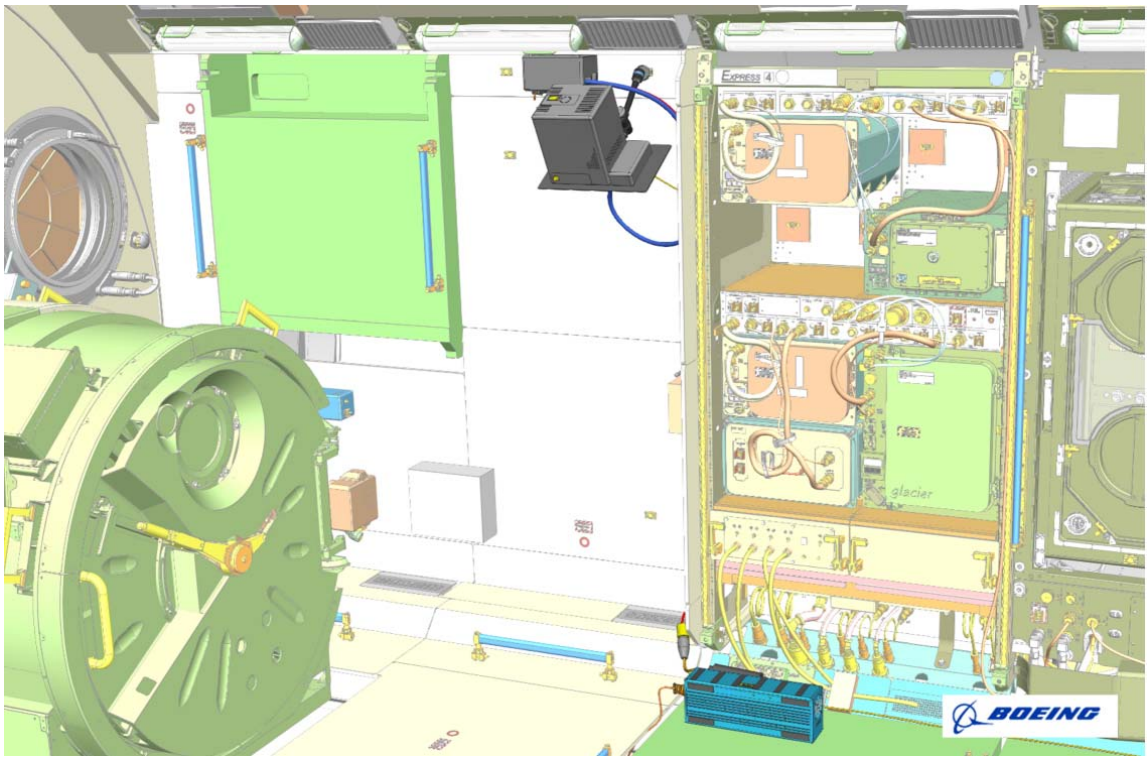
- First demonstration of an operating electron microscope -- a complex optomechanical system -- in the orbital environment. Mochii is the first instrument of its kind ever to be placed in space.
- Perform valuable experimental mission science with results obtained real-time on orbit so that samples do not have to be sent back to Earth before critical mission decisions. Turnaround time of 3 months for an analysis is typical whereas Mochii can perform analyses same-day.
- Real-time collaboration between astronauts and support personnel on the ground in a unified software interface will be tested for efficiency of gathering mission-critical science.

Mochii will be installed into the ISS JEM module where it will connect to the ISS WiFi network. Mission operators on the ground will confirm nominal telemetry and perform operations on test samples loaded into Mochii, acquiring the first electron microscope images acquired in space.

Mochii will be powered on 24/7 to provide data for experiments on ISS. ISS crewmembers will command Mochii using iPads in the ISS, and scientists, technicians, and stakeholders on Earth will command Mochii through NASA's KuIP networking infrastructure. Voxa has worked extensively with NASA to ensure Mochii's communications are compliant with NASA's security requirements and interference limits.

Transmitter Information

A single Mochii will be mounted inside the ISS's JEM module, as shown below (exhibit "Diagram of Mochii installed in ISS").



Mochii contains two on-board computers, each containing a small integrated antenna. Both antennae are capable of both WiFi and Bluetooth communications. The primary antenna is used for 2.4 GHz and 5 GHz WiFi and also standard Bluetooth and Bluetooth Low Energy (BLE). The secondary antenna uses standard Bluetooth only, but is capable of 2.4 GHz WiFi as well. The peak possible power output for both antennae is 30 mW each. The gain values are 3.5 dBi and 2.0 dBi, respectively.

The primary antenna is part of the main on-board computer. Its purposes are:
- Connection to 2.4 GHz and 5 GHz WiFi networks to communicate with the outside world.
- Allow users in close proximity (ISS crew members) to configure Mochii network settings via BLE.
- Communicate with the secondary on-board computer over a high voltage gap via standard Bluetooth.

The secondary antenna is part of a secondary on-board computer, and its sole purpose is communicating with the main on-board computer via standard Bluetooth across a high voltage gap.

Included as exhibits in this application are photos of Mochii on Earth and its location on the ISS, and NASA's EMI (electromagnetic interference) test results for Mochii.

Orbital Characteristics

Mochii will be installed inside the ISS. The ISS orbits the earth with the following parameters:

Inclination angle: **51.6°**
Apogee: **410 km**
Perigee: **408 km**
Period: **1.545 hours**

Mochii does not qualify as a satellite system as described in CFR Title 47 Part 5.64. It is a small microscope, roughly the size of a personal coffee maker, mounted internally inside the ISS. Mochii does not have the capability to image or sense the Earth's surface. Mochii can only image small samples loaded internal sample chamber. Typical samples investigated using Mochii are under 5mm in dimension.

Since Mochii is meant to image tiny internal samples in space, and not produce imagery the Earth's surface, it is not classified as a remote sensing device, therefore a NOAA license is omitted.

Since Mochii is integrated into the ISS and is dependent on ISS power, the device would not be able to transmit during a deorbit (catastrophic) event. For this reason the Orbital Debris Assessment Report (ODAR) is omitted.

Interference Coordination

Immediate requests for Voxa regarding transmission should be directed to one of the following:

Christopher Own
csown@projectvoxa.com
415-858-0393

Theodore DeRego
tedsta@projectvoxa.com
808-769-0487