

### Experiment Description:

Two transceivers, mounted on a pair of high altitude balloons (one transceiver on each balloon), will be utilized as part of a federal research contract. The purpose of the experiment is to measure the crosslink propagation characteristics of these transceivers to determine their viability for use as low rate crosslink radios. The launch point of the balloons/payloads is just north of Sioux Falls, South Dakota. The anticipated area of operation is between 42N to 48N latitude, and 98W to 88W longitude. The altitude of the transceivers will be between 50,000 to 68,000 feet, with a target altitude of approximately 60,000ft. The flight duration is expected to be between 2 to 7 days. However, the transmitter will not be active continuously as the payload will be duty cycled during the flight by the flight control team (determined as necessary due to other factors concerning the flight and therefore not currently known). Only one flight will occur in a launch window as specified in the Start/Stop dates of this application filing.

The balloon/payload transceivers will be connected to a low gain omni directional antenna. The radio system (RFM69HCW module from Hope RF, which is based on the Semtech SX1231 RFIC) will have a maximum power level of +20dBm, into a 3.5dBi omni antenna, for a maximum Effective Isotropically Radiated Power (EIRP) level of +23.5 dBm. The antenna will be linearly polarized, mounted in the vertical direction.

All transmissions will be periodic around 10 second intervals, and will be short duration (approximately 50 milliseconds per burst), narrowband (<25 kHz), 9600 baud, and GMSK modulated.

### Applicability of Experimental / STA licensing:

The radio system will be used as part of a high altitude balloon mission under federal contract (FA8002-17-C-0196). The radio system exceeds FCC limits for use as an unlicensed lower power system, and since it is being operated under a federal contract, it is not acceptable to operate under Part 97 Rules due to monetary compensation for operation of the radio as part of the larger federal contract goals. However, the radio system will be used in future missions as a cube satellite crosslink radio system, which will likely be licensed under Part 97 rules (or Part 5 Rules as details of the cubesat mission become more defined). For the Federal Contract, to which this application for an STA pertains, the radio is being utilized to characterize crosslink communications between two high altitude balloon payloads as described in the Experiment Description section of this exhibit. As a byproduct of this operation, experimental data will be collected concerning the utility of these low power radios for long range communications (10-100 km), which is relevant to the future cubesat crosslink mission.

Below are Excerpts from '§ 5.3 Scope of service' showing the relevant applicability of the Experimental Service (and due to the short duration of the mission, specifically the Special Temporary Authority license) for this license request. Sections below in brackets [] indicate comments inserted from the author of this exhibit.

#### § 5.3 Scope of service:

Stations operating in the Experimental Radio Service will be permitted to conduct the following type of operations:

(a) Experimentations in scientific or technical radio research.

[Testing future experimental cubesat crosslink radio system.]

(c) Experimentations under contractual agreement with the United States Government, or for export purposes.

[Virginia Tech Applied Research Corporation research program under Federal Contract: FA8002-17-C-0196]

(d) Communications essential to a research project.

[Yes, crosslink communications via this radio link is required to ensure test objectives are achieved.]

(e) Technical demonstrations of equipment or techniques.

[Testing future experimental cubesat crosslink radio system.]

j) Development of radio technique, equipment, operational data or engineering data, including field or factory testing or calibration of equipment, related to an existing or proposed radio service.

[In future use of this technology, and based on the data collected during the mission, the specific radio system will be used aboard a cube satellite licensed in the Amateur Radio Service under Part 97 Rules in the spirit of advancing the radio art which is a fundamental tenant of the Amateur Radio Service.]

Stop Buzzer / Questions:

Transmissions under this License may be stopped by contacting Kevin Sterne at (724) 747-2876.