

Experiment Description:

Three transmitters will be utilized as part of a federal research contract. These include one payload transmitter mounted on a high altitude balloon and two transmitters mounted on Mobile Ground Stations (MGS). The launch point of the balloon/payload is Baltic, SD. The anticipated potential overflight area (subject to stratospheric wind conditions) is between 39N to 46N latitude and 105W to 92W longitude. The altitude of the transceiver on board the balloon will be between 50,000 to 68,000 feet with a target altitude of around 65,000 ft. Maximum duration of the flight (payload/MGS transmitters active) is 12 hours. Minimum duration of the flight is 2 hours. Only one flight will occur in a launch window as specified in the Start/Stop dates of this application filing.

The balloon payload transmitter will utilize a low gain omni directional vertically polarized dipole antenna. The balloon transceiver system (RFM69HCW module from Hope RF, which is based on the Semtech SX1231 RFIC) will have a maximum power level of +33 dBm, into a 3.5dBi omni antenna, for a maximum Effective Isotropic Radiated Power (EIRP) level of +36.5 dBm (4.5 Watts).

The Mobile Ground Stations, operating at ground level, will utilize M2 Antennas Inc. 436CP14 antennas with 13.5 dBi of gain, Right Hand Circular Polarization, and a 42 degree beamwidth (3dB). The MGS antennas will track the balloon keeping boresight gain directed towards the balloon at altitude. One MGS will stay close to the launchpoint, near coordinates 43.700387, -96.707818 while the second MGS will start at those coordinates, but may go mobile and chase the balloon somewhere in the operating region listed above (maximum 12 hour drive radius from the launchpoint). The ground based transceiver system (RFM69HCW module from Hope RF, which is based on the Semtech SX1231 RFIC) will have a maximum power level of +33 dBm into a 13.5 dBic antenna for a maximum EIRP of 46.5 dBm.

All burst transmissions (1 minute periodic telemetry bursts from the balloon payload transmitter, sporadic command uplinks from the MGSs, and data downlinks) will be short duration (approximately 50 milliseconds), narrowband (<25 kHz), 9600 baud, and GMSK modulated.

As a reference, these experimental radio systems are an improved version of systems that were granted Experimental (STA) licenses under the callsigns WL9XCM and WL9XPE.

Applicability of Experimental / STA licensing:

The radio system will be used as part of a high altitude balloon mission under federal contract to Virginia Tech (VT). 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 systems onboard the balloon will be used in future VT educational student oriented missions as a cube satellite crosslink and/or downlink radio system (as well as for smaller educational high altitude balloon missions), which will likely be licensed under Part 97 rules (or Part 5 Rules, depending on mission requirements). For the Federal Contract, to which this application for an STA pertains, the radios are being utilized as part of the primary payload command and control system 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 to 200+ 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 and/or downlink radio system.]

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

[This system is being operated as part of an experiment under federal contract to Virginia Tech. For more information, please contact the POC referenced in the Stop Buzzer / Questions section of this exhibit.]

(d) Communications essential to a research project.

[Yes, radio system required as primary payload command and control system to help ensure test objectives are achieved.]

(e) Technical demonstrations of equipment or techniques.

[Testing future experimental cubesat crosslink and/or downlink 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 the envisioned future use of this technology, and based on the data collected during the mission, the specific radio system will potentially be used aboard VT built and operated cube satellites 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 (or under Part 5 rules should the mission requirements dictate this).]

Stop Buzzer / Questions:

Transmissions under this License may be stopped by contacting Zach Leffke at (540) 231-4174 (office) or (540) 808-6305 (cell). For any other inquiries please contact via email at zleffke@vt.edu.