

**Albi Fly LLC**  
**Technical Exhibit to Application for Experimental License**  
**File No. 0967-EX-CN-2020**

**Purpose of this application**

The purpose of this application is to obtain a 2-year experimental license to operate a GPS Re-Radiation system to support the testing and development of GPS, GLONASS, and Galileo receivers on experimental aircraft.

Pursuant to Section 5.3 (f), Section 5.51 and Section 5.53 of the Federal Communications Commission ("FCC") rules, 47 C.F.R. §§ 5.3 (f), 5.51, 5.53 (2017), Albi Fly LLC ("Albi Fly") respectfully requests the granting of an experimental license to operate a GPS re-radiator for purposes of testing the performance, functionality and safety of autonomous aircraft during developmental testing and maintenance.

In support of Albi Fly's request, which is in compliance with NTIA Manual Paragraph 8.3.28, the following is shown:

**1) Applicant's Address, Background and FRN:**

Albi Fly LLC  
780 Lynnhaven Parkway  
Suite 400  
Virginia Beach, VA 23452

FRN: 0028441475

**2) Background and Need for License**

Albi Fly LLC (hereafter, "Albi Fly"). Albi Fly is a company involved in researching and developing management and operational tools and solutions for businesses. Albi Fly is developing autonomous unmanned aircraft systems with the goal of the aircraft being utilized for delivery services. These aircraft utilize GPS, GLONASS, and Galileo for navigation. The development of these aircraft requires frequent tests and evaluations of the GPS/GLONASS/Galileo receivers and antennas on the aircraft. Presently, the aircraft must be moved outside of the hangar to perform these tests, which results in environmental exposure and the potential for third parties to observe confidential equipment. Additionally, aircraft undergoing maintenance may be partially disassembled and attached to ground support equipment that is unable to be moved outside. The use of a GPS re-radiator will allow for this testing to be conducted indoors without these issues.

The number of aircraft and the need to work with ground support equipment makes the use of GPS hoods impractical compared to a re-radiator. The GPS re-radiation system will comply with all NTIA requirements.

Under the license, Albi Fly will transmit GPS/GLONASS/Galileo signal input to the aircraft hardware while indoors and wholly within the aircraft development and test facilities. The transmission of GPS/GLONASS/Galileo input is necessary to accurately test and validate the performance, functionality, and safety of unmanned aircraft systems.

### **3) Location of Sites:**

The testing will be conducted at a warehouse in Patterson, California. The building is owned by and under the control of Amazon. The coordinates of the site are 37.471367, -121.165584.

### **4) Compliance with NTIA Requirements**

- a) **Individual authorization is for indoor use only, and is required for each device at a specific site.**

Operation will only be conducted indoors at the location identified above and at the station location in the application form 442.

- b) **Applications for frequency assignment should be applied for as an XT station class with a note indicating the device is to be used as an "Experimental RNSS Test Equipment for the purpose of testing GPS receivers" and describing how the device will be used.**

Albi Fly concurs with the XT station class. The description of device use is contained in this document.

- c) **Approved applications for frequency assignment will be entered in the GMF.**

Albi Fly concurs with this requirement.

- d) **The maximum length of the assignment will be two years, with possible renewal.**

Albi Fly concurs with this requirement

- e) **The area of potential interference to GPS reception (e.g., military or contractor facility) has to be under the control of the user.**

This is under Albi Fly's control.

- f) **The maximum equivalent isotropically radiated power (EIRP) must be such that the calculated emissions are no greater than -140 dBm/24 MHz as received by an isotropic antenna at a distance of 100 feet (30 meters) from the building where the test is being conducted. The calculations showing compliance with this requirement must be provided with the application for frequency assignment and should be based on free space**

**propagation with no allowance for additional attenuation (e.g., building attenuation.)**

Calculations are supplied below in the section entitled "System technical description" and comply with this requirement. The computations include no allowance for additional attenuation.

- g) **GPS users in the area of potential interference to GPS reception must be notified that GPS information may be impacted for periods of time.**

Albi Fly will comply with this requirement.

- h) **The use is limited to activity for the purpose of testing RNSS equipment/systems.**

The use of this system will be limited to testing RNSS equipment and systems.

- i) **A "Stop Buzzer" point of contact for the authorized device must be identified and available at all times during GPS re-radiator operations.**

Stop buzzer contacts are provided in this document.

## **5) FCC Station Codes:**

The FCC radio service code and station class code for the proposed operation are "XT" and "FX," respectively.

## **6) Equipment To Be Used:**

Albi Fly proposes to operate at the site a single transmitter capable of operating on the channels listed in Section 7 below. Specifically, it proposes to deploy a transmitter (Model L1/L2GHNRRKIT) manufactured by GPS Networking. The technical specifications of the equipment are provided under Attachment A. The re-radiating amplifier is the model capable of variable gain.

## **7) Frequencies Desired:**

As stated in Section 2 above, Albi Fly seeks to obtain real-world data samples of the characteristics of GPS, GLONASS, and Galileo transmissions. Thus, it is critical for Albi Fly to conduct tests centered on GPS channels 1227.6 MHz and 1575.42 MHz, GLONASS channels 1602.0-1615.5 MHz, 1246.0-1256.6 MHz, 1598.0625-1605.375 MHz, 1242.9375 – 1248.625 MHz, and Galileo channels 1575.420 MHz, 1278.750 MHz, 1191.795 MHz, 1176.450 MHz, and 1207.140 MHz. Albi Fly recognizes that the use of certain frequencies will require coordination through the Interdepartment Radio Advisory Committee ("IRAC"), and it is amenable to coordinating with representatives of IRAC prior to commencing any transmissions.

## **8) Power Level:**

Albi Fly will operate with the minimum necessary power to conduct its tests, and in no event will that level exceed the levels set out in the table provided under Attachment B. The re-radiating amplifier gain will be set to the lowest gain practical. Specifically, the maximum equivalent isotropically radiated power ("EIRP") will be such that the calculated emissions are no greater than -140 dBm/24 MHz as received by an isotropic antenna at a distance of 100 feet (30 meters) from where the tests are being conducted. A link budget showing compliance with this requirement is provided in the table under Attachment B and is based on free space propagation with no allowance for additional attenuation (e.g., building attenuation).

#### **9) Type of Emission, Modulation Technique, and Bandwidth Required:**

The primary emission designator for the proposed operations is 2M46G3D, as indicated on the accompanying FCC Form. Other emission modes and modulation techniques may be utilized, but in no event will the emissions extend beyond the limits associated with the above-referenced emission.

Albi Fly does not propose to supply station identification as set forth in Section 5.115 of the Commission's Rules, 47 C.F.R. § 5.115 (2017).

#### **10) Antenna Information and Compliance with Human Exposure Limits:**

Albi Fly will comply with all Federal Aviation Administration ("FAA") and FCC rules and regulations regarding the installation and operation of antennas and their support structures. The antenna to be deployed under the authority requested will not extend more than six meters above the building.

#### **11) Restrictions on Operation:**

GPS, GLONASS, and Galileo users in the area of potential interference to GPS reception will be notified that GPS, GLONASS, and Galileo information may be impacted during testing. In addition, Albi Fly will post signs on doors to the test area notifying that, "GPS re-radiator is in use and the GPS/GLONASS/Galileo information you receive may be in error."

Albi Fly also understands that: (a) permission to operate has been granted under experimental authority issued by the Federal Communications Commission, is strictly temporary, and may be cancelled at any time and that (b) operation is subject to the condition that it not cause harmful interference.

Moreover, Albi Fly does not propose to market, sell, or lease unapproved equipment to end users or conduct a market study in conjunction with these tests. After the completion of the tests, Albi Fly will recover all devices that do not comply with FCC regulations.

## 12) Interference Protection/Stop Buzzer Contact Information:

As noted above, GPS, GLONASS, and Galileo users in the area of potential interference to GPS, GLONASS, and Galileo reception will be notified that GPS, GLONASS, and Galileo information may be impacted during testing.

Albi Fly also understands that it may be required to discontinue its operations immediately, if any interference occurs. Albi Fly does not expect interference to occur, however, as its tests will be conducted only on a limited basis and only periodically during the term of its experimental license. Moreover, Albi Fly personnel will be monitoring the RF spectrum and will take steps to minimize any potential for interference.

The power switch for the re-radiator will be clearly marked and illuminated red when the system is operational. This serves as an indicator that the system is operational and reminds personnel to turn the system off when testing is complete.

Albi Fly advises the Commission that Jay Lee is the technical contact overseeing these tests. He will be personally responsible for the operations and will serve as the “stop buzzer” in the event that operations must be terminated because of any interference concerns. The backup stop buzzer contact will be Evan Terry.

Primary Stop Buzzer	Secondary Stop Buzzer
Jay Lee Mobile: 253-355-6520 Email: <a href="mailto:leiy@amazon.com">leiy@amazon.com</a>	Evan Terry Mobile: 407-913-7567 Email: <a href="mailto:terryeva@amazon.com">terryeva@amazon.com</a>

## 13) Application Contact Information:

Company Contact	“Stop Buzzer” Contact	Legal Contact
Darryl Smith 780 Lynnhaven Parkway Suite 400 Virginia Beach, VA 23452 (800)927-9801	Jay Lee Mobile: (253)355-6520 Office: (206)266-1000 1901 NW 56th Drive Pendleton, OR 97801	Samuel Cullari Reed Smith Three Logan Square 1717 Arch Street Suite 3100 Philadelphia, PA 19103 Mobile: (609)781-6272 Office: (215)241-7904 <a href="mailto:scullari@reedsmith.com">scullari@reedsmith.com</a>

## **ATTACHMENT B**

### **Link Budget Calculations**

The following calculations represent the architecture of the proposed GPS re-radiation configuration and the signal power calculations which demonstrates compliance with NTIA Manual 8.3.28.

	Individual element	Cumulative total
GPS signal received power from GPS spacecraft	-130	-130 dBm
Receive Antenna pattern gain (estimated)	3	-127
Receive Antenna amplifier gain (datasheet)	40	-87
Transmission line loss to re-radiator antenna (estimated)	- 7.8	-94.8
Re-radiator amplifier (variable gain, may be configured lower, values from datasheet)	11	-83.8
Re-radiator antenna gain (datasheet)	3	-80.8
<u>Free space path loss (FSPL) at 100 feet from Building (re-radiator positioned 20 feet inside from exterior wall, total free space path length 120 feet)</u>	<u>-64</u>	<u>-144.8 dBm</u>

These calculations indicate that the re-radiator will not re-radiate GPS signals greater than -140dBm/24 MHz at 100 feet from the re-radiation source.