From: Michael Staring

To: Behnam Ghaffari
Date: June 04, 2019

Subject: 0412-EX-CN-2019

Message:

FCC Application
Form 442 Confirmation Number: EL529982
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Rada Technologies LLC
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Detailed Radar Test Outline
Scope
The purpose of this document is to outline the test and operation procedure carried out during testing of the RADA Technologies, LLC (RTL) radar systems. The general test or demonstration procedure described in the following sections serves as a guide to configuring, testing, and analyzing the system performance regardless of the environment, conditions, or intended detection target. Previous testing required by RTL has been carried out by SAZE Technologies, LLC to ensure proper licensing with the FCC. The RTL application is to establish FFC approval for RTL to conduct the same scope of testing as performed by SAZE. The SAZE FCC documentation can be found under the following numbers for reference:

SAZE FCC Radio Station Construction Permit and License
Name: SAZE Technologies, LLC
Call Sign: WH2XLN
File Number: 0389-EX-RR-2016
Nature of Service: Experimental
Class of Station: XC MO

Initialization
Testing conducted by RTL would be performed within a one hundred (100) mile radius of the submission address. This radius will account for the various terrains and environments that will be of interest to test experimental radar systems. The following sample test procedure is based on a test performed at Butler’s Orchard in Germantown, MD (Private property, test area usage coordinated with land owners at pre-determined site) on an MHR radar system. However, it may be adapted for any other RTL radar system being tested in other locations.

The pre-determined location will serve as the fixed radar station with a standalone generator for power and computer station for system monitoring and analysis. The fixed radar station is positioned in the open field, facing the test area. Radar face configurations generally consist of one face, providing 90 degrees of azimuth and elevation coverage, or two faces, providing 180 degrees of azimuth and 90 degrees of elevation coverage. Figure 1 illustrates the coverage pattern of a single and double radar face configuration.

Upon startup, the radar is configured with the necessary parameters for the desired test. Operational frequency is set between 3.3 GHz and 3.4 GHz prior to testing and could be adjusted throughout this range during the test process to improve radar performance depending on signal noise and detection performance. This allows the operator to configure the radar system to detect a defined range/altitude and report detected targets depending on radar cross section (RCS), air speed, altitude, and flight characteristics. Detailed RF parameters can be adjusted to improve accuracy and resolution of RCS detections. By adjusting the radar beam patterns and characteristics, it is possible to focus the evaluated area to a specific region in the test area. This is done to minimize detection errors and improve tracking performance once the test target is detected.

During field tests and demonstrations, radar transmission patterns are calibrated to operate up to ranges of 3 to 6 Kilometers (1.86 to 3.72 Miles). Altitude detection settings can be configured to detect and report targets up to 400 ft. AGL. Test targets are generally commercial drones piloted by a licensed UAV pilot, in accordance with FAA UAV flight procedures. Various size UAVs are utilized ranging from small commercial quadcopter to medium sized fixed wing hobby aircraft. The small RCS of these aircraft is ideal for evaluating experimental radar capabilities and demonstrating current tracking capabilities of the radar system.

Calibration

After initial startup and configuration, the radar system must undergo a calibration process to verify the system is operating properly. This involves flying the UAV throughout the test area in controlled patterns to verify position, altitude, heading, and airspeed of the aircraft. The position coordinates of the UAV can be cross referenced with the radar to ensure proper detection and classification of the UAV. Various flight patterns such as straight line, sweeping banked turns, pivot turns, and multi-point flight paths allow the radar operator to verify system performance and adjust the radar parameters to better detect the UAV while reducing false readings caused by trees, birds, and nearby obstacles. In some radar configurations, it is possible to distinguish between rotorcraft and non-rotorcraft objects. This provides a distinction between birds and other objects from fixed wing hobby aircraft and multi-copters. The calibration process can take between two to four hours after initial setup.

Testing

After the calibration process, the test process will involve multiple flights of the UAV over the pre-defined flight path during calibration. During the UAV flight, configurations and parameters of the radar are adjusted to optimize detection of the UAV and distinguish from other detections. Experimental configurations for the radar software and hardware can be tested during this time to detect the UAV on known flight paths. The system is continuously radiating to the test area during the time of the trial and will only be disabled during reconfiguration.

Unplanned maneuvers can be introduced to the flight path of the UAV to verify the traceability of the radar in new configurations. The data collected from the testing process is downloaded to the primary computer station for analysis. The recorded data consists of position, heading, altitude, RCS, and speed that can be used to classify and analyze detections. By analyzing the data after testing, it is possible to verify the radar performance and determine parameters that need to be changed to optimize performance.

Demonstration

Demonstrations are conducted by the same controlled process as the testing procedure to properly evaluate and demonstrate the radar capabilities. Known UAV flight patterns are used with previously tested radar configurations. The purpose of these demonstrations is to present the radar performance in realistic scenarios. This will consist of radiating the radar beam into the field with a detection range of up to 4 Kilometers (2.48 Miles) and an altitude of 400 ft. AGL for small to medium sized objects. Demonstrations can run between two to six hours.

For any additional information please contact Alex Filie at afilie@radatechllc.com, 301 337-9385.

Update

Received this and response has been provided (duplicated here for completeness):

Mike,

I just read your statement and could you provide the height of UAV’s AGL during transmission and the proposed ERP (=Output Power + Antenna Gain).

Regards,

Ben

We fly the UAV between 90 – 300 ft AGL. Think 400 ft is the FAA limit for UAVs, and we give ourselves a buffer space to the limit in case of winds, obstacles, etc.

Also, our average power is 60 watts, with a maximum transmitted power of 328 watts – it is user

defined.
Please let me know if you need any additional information …
Regards,
Mike Staring, mstaring@radatechllc.com, 703 328-4011