

W-band Airborne Radar Description

This document describes the General Dynamics W-band airborne radar system for the purpose of obtaining a temporary experimental FCC license. The purpose of the license modification is to increase the transmit power from 0.5 W peak to 1 kW peak.

System Description and Operational Area

This radar system is used for ground imaging research using traditional synthetic aperture radar techniques. The sensor is located on an aircraft flying at approximately 15,000 ft to 25,000 ft altitude. The aircraft will operate within a 50 mile radius of the General Dynamics facility located at N 42° 13' 15", W 83° 37' 51". It is expected that this radar will be operational only 20 hr every month over 3 years.

Antennas

The radar antennas are located on a rotational pedestal mounted to the underside of the aircraft, which allows the antennas to view the ground. The rotational pedestal can point the antennas at depression angles between 30 and 60 degrees below the aircraft horizon. The pedestal can point the antennas within 20 degrees of the side of the aircraft. The radiated signal will reach the ground at elevation angles between 30 and 60 degrees. The horizontal angle that the signal will reach the ground is dependent on the orientation of the aircraft. It should be assumed that the signal will reach the ground over all azimuth headings.

There are separate transmit and receive antennas located next to each other. The antennas are custom-designed. Transmit and receive antennas are identical. The gain of the antennas is 40 dB at 94 GHz, and the antennas have a 1.5 degree half-power beamwidth in both the azimuth and elevation planes.

Waveform

The radar will use a pulsed linear-FM chirp waveform. The waveform will be centered at 94 GHz and have a bandwidth of 600 MHz. Signals outside this bandwidth will be filtered and will be at least 50 dB below the desired signal. The waveform will have a maximum duty factor of 50%. The width of the waveform pulse will be approximately 20 microseconds and operate at a PRF of approximately 10 kHz.

Transmit Power

The radar will transmit a waveform with a peak power of 1 kW. Factoring in the antenna gain, the broadcast peak ERP (transmit power + antenna gain) is 10,000,000 W (70 dBW). The radar will operate at a maximum of 3% duty factor, so the maximum average power emitted by the radar is 30 W, with an equivalent maximum average ERP of 300 kW (54.8 dBW).