Silent Multi-Mode Radar (SMR)

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The Silent Multi-Mode Radar (SMR) supports three operating modes: silent, pulse-doppler, and FMCW. SMR operates in the license-free 5.8 GHz ISM band with 10 watts from the transmitter and 15.5 dBi gain from the transmit antenna. Transmit polarization is RHCP.

While in silent mode, the system generates below -102 dBm/Hz EIRP outside a range of 10 Kms. In silent mode, the radar implements a randomly changing pulse spreading algorithm with an expected range of 150 Kms and 6 meter resolution. The silent mode concept pushes the illumination power spectral density close to the noise floor to lower the probability of detection while reducing the opportunity of accidental or deliberate jamming. The random nature of altering the spreading algorithm makes it nearly impossible for a sophisticated receiver to detect the illumination and generate interference. The anti-jam/anti-detection passive-like nature of the radar will be of interest for DOD application.

Pulse-doppler mode was added to support the Golden Dome Research effort and will specifically capture high-rate IQ data, down-converted to base band, on dual removable 4 TByte eSATA hard drives for post analysis. The record format is similar to that of the NEXRAD WSR88D radar.

The low-noise receiver shown on page 1 includes four Xilinx Kintex-7 processing boards and ADRV9008-1W RF front-end interfaced via a PCIe Gen4 X16 backplane. The low-noise receiver provides dual receive paths with tunable RF bandwidth from 75 MHz to 6 GHz, 200 MHz IF bandwidth, 16-bit ADC resolution, and receiver band spurs < -95 dBm per 10 MHz receiver bandwidth. Each Kintex-7 FPGA board provides 1 Gbyte of DDR3 memory, 478K logic cells, 34 Mbytes block ram, and 1,920 DSP slices of FPGA fabric along with numerous I/O interfaces. The intent of the low-noise receiver is not only to serve as a low-noise receiver; but, to provide enormous resources to perform real-time IQ data processing, object recognition, and object tracking.

The receive antenna is a LHCP 3 ft parabolic dish with 3.3 deg beamwidth, 34 dBi gain, and > 30 dB cross-polarization isolation.

Future versions of the SMR, as funding becomes available, will operate in the 28 GHz ISM band and the parabolic receive antenna will be replaced with a phased array for improved size, weight, and performance.