Additional Information for Application 0120-EX-ST-2014

Background

SAZE Technologies, LLC is funded by the U.S. Defense Advanced Research Projects Agency (DARPA) (through a subcontract to Syracuse Research Corporation) to develop techniques that enable radars and communication systems to share spectrum. This will be achieved by developing radar waveforms that simultaneously carry communications data. The prime contract number is N66001-16-C-4009. The DARPA Program Manager and technical point of contact is Dr. Joseph Evans. His phone number is (571) 218-4446 and email is joseph.evans@darpa.mil .

Description of Experiments

To perform the experiments, two communications-radar systems integrated from ETTUS X-310 Software Defined Radios will be used.

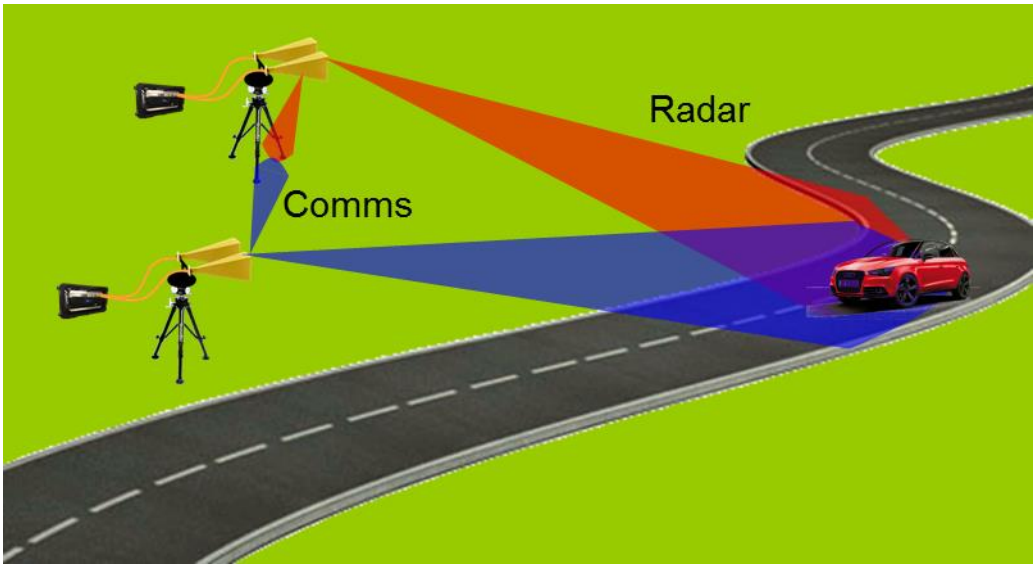

Figure 1: Example experimental scenario.

The planned experiments involve the coordination the two SDR radar systems so that they near-simultaneously illuminate targets. During the experiments each SDR radar will be mounted on a Tripod. The maximum height that the antenna can be mounted on the tripod is about 2.m. In a typical experiment it is expected that the radar antenna will be set up at a height of about 1.5m (5 feet).

The aim of the experiments is to validate and demonstrate waveforms that simultaneously illuminate targets (radar) and communicate. It is expected that the radar part of the experiment will be accomplished through illumination of the target with the antennas' mainbeams and communications will be accomplished simultaneously through the antennas' sidelobes. A successful experimental outcome will show that the target is detectable while communications data is simultaneously transmitted between the

two systems. The two systems will operate in a frequency division duplex mode with a separation of between 10 MHz and 30 MHz. Each system will occupy a bandwidth of up to 10 MHz. The system will operate in the 2.7 GHz to 3.1 GHz radar band.

Description of Software Defined Radio Radar System

The components of the SDR radar system are shown in Figure 2 below.

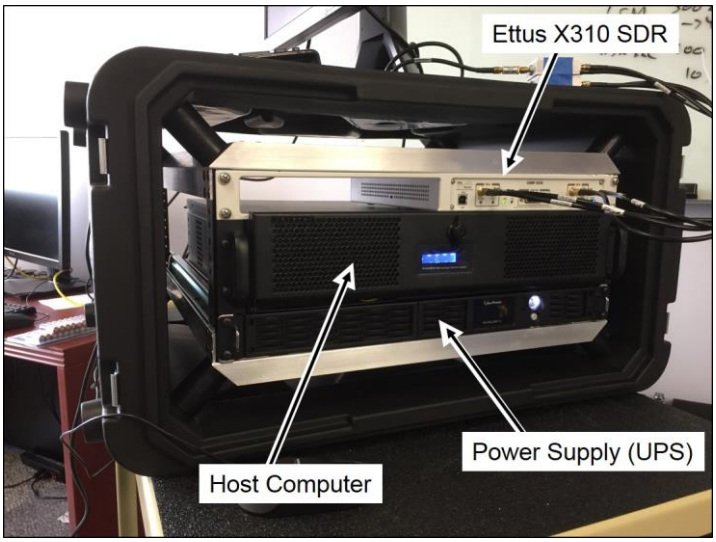

Figure 2: SDR Radar System being tested in the laboratory.

The software defined radio radar system is configured as follows:

- Ettus X310 Software Defined Radio with UBX160 Daughter card https://www.ettus.com/product/details/X310-KIT
- Mini Circuits VBF2900+ Bandass Filter http://www.minicircuits.com/MCLStore/ModelInfoDisplay?14704069113450.2405199776255048
- Ettus GPS Disciplined Oscillator (GPSDO) https://www.ettus.com/product/details/GPSDO-MINI
- Host Computer
- Diamond Antenna horn antennas mounted on a tripod.

The software defined radar operating parameters are as follows

- Transmitter
  - power: 100 mw
  - Operating frequencies: 2.7 GHZ to 3.1 GHz
  - Bandwidth: 1 MHz to 10 MHz
  - Waveform: Phase shift keyed
  - System will operate in a continuous (100% duty factor mode).
- Antenna

- Gain: 12 dBi
- Beamwidth: 45°

Figure 3 below shows a wideband (2 GHz to 12 GHz) spectrum analyzer plot of the software defined radio radar's output. No harmonics or other spurious emissions are observable.

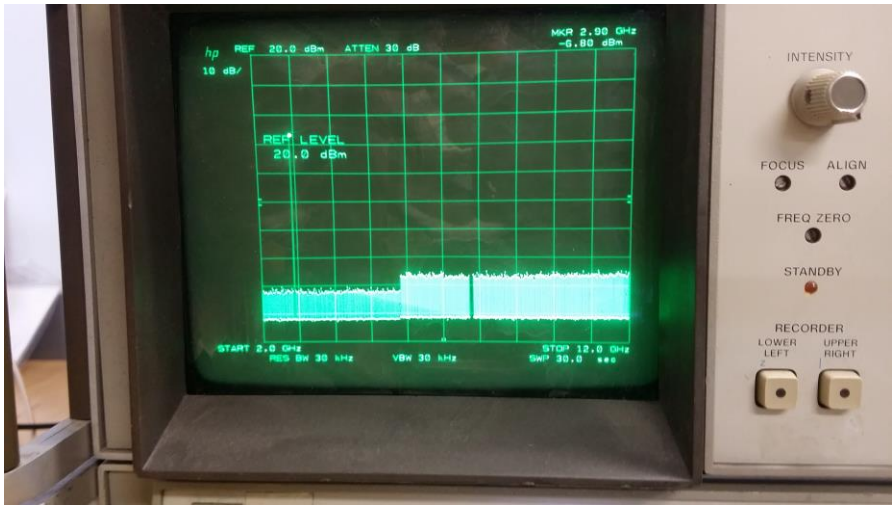

Figure 3: Wideband spectrum analyzer plot of the SDR Radar System's transmissions.

Figure 4 below shows a medium bandwith (1 GHz to 4.4 GHz) spectrum analyzer plot of the software defined radio radar's output. Spurious emissions are observable.

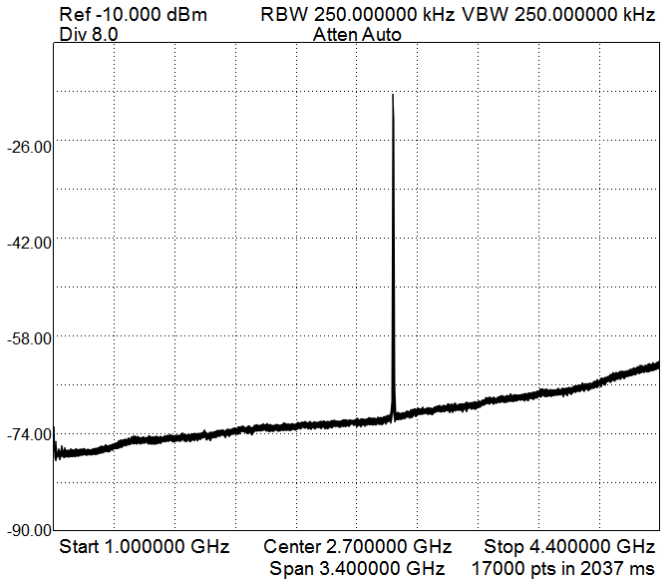

Figure 4: Medium bandwidth spectrum analyzer plot of the SDR Radar System's transmissions

Figure 5 below shows a narrowband (2.85 GHz to 2.95 GHz) spectrum analyzer plot of the software defined radio radar's output. No spurious emissions are observable and the transmission is tightly contained within the allotted bandwidth.

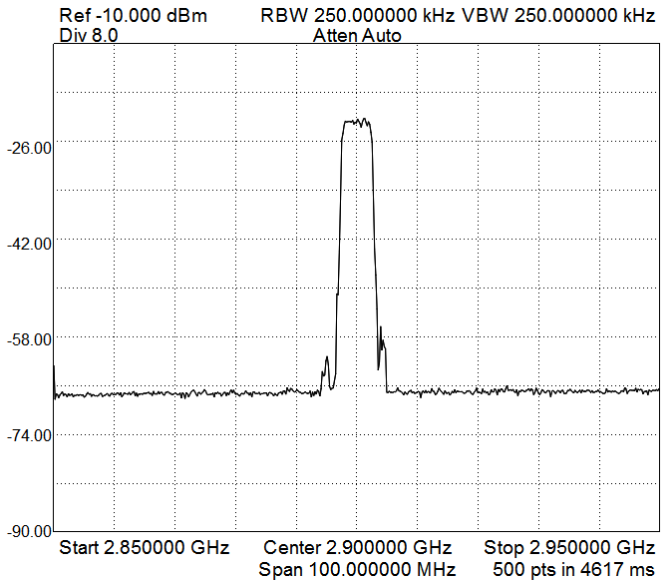

Figure 5: Narrowband spectrum analyzer plot of the SDR Radar System's transmissions

SAZE Technologies, LLC would be happy for FCC staff to come and inspect the equipment and/or observe some of the experiments. Please feel free to contact us with any questions or concerns you may have.