2D Millimeter-wave Phased Array Radar

As a spin-off of research efforts at the University of Michigan, Savium Technologies has developed a new compact, low cost millimeter-wave phased array. By using a hybrid MMIC (monolithic-microwave integrated circuit) architecture, novel low-loss beam-forming networks, and a newly developed miniature horn antenna array, this low-cost switched-beam ESA (electronically scanned array) radar has excellent bandwidth, superior range resolution, and compact size. Applications of this system include automatic collision avoidance radars and blind-spot sensors.

Due to the low-loss passive beam-forming network, just a single transmit/receive module is needed for the phased array radar. The beam-forming network consists of a microstrip lens phase-shifting component with enhanced focusing and a PIN diode switch network for electronic beam control.
The millimeter-wave phased array radar is based upon an FMCW waveform implementation. This approach takes advantage of the wide system bandwidth, which reduces the required transmit power, and thereby alleviates the need for added MMIC subassemblies. Additional functionalities, such as simultaneous control of multiple beams, polarimetric capabilities with independent vertical and horizontal polarization channels, and scanning in elevation are also available.

Performance specifications:

Architecture: Switched beam ESA (electronically scanned array)
Field of view (azimuth): 49 degrees\(^1\)
Beam control: SP8T PIN diode switch for 8 beams\(^2\)
Operating frequency: 34 to 40 GHz\(^3\), 16 percent bandwidth
Waveform: FMCW
System gain: 15.6 dB maximum, 12.0 dB minimum
Range: 100+ meters
Range resolution: < 0.1 meter
Size of ESA: 5.0 x 4.5 x 0.3 inches

Optional Functionalities:
- Simultaneous control of multiple beams
- Polarimetric mode with independent vertical and horizontal polarization control
- Stackable tray architecture for beam scanning in both azimuth and elevation
- Double sided circuitry for monopulse operation

\(^{1}\) The field of view can be modified based upon the designed beam-forming network
\(^{2}\) The number of beams is expandable based upon the switch matrix implementation
\(^{3}\) The phased array system is readily scalable for X, Ku, Ka, Q, V, and W bands