ABSTRACT

The use of millimeter wave radar (mm-wave) for various purposes continues to increase. One of them is the use of radar in detecting vital sign of breathing. Non-contact respiratory detection can provide benefits in broader fields such as disaster mitigation in the process of detecting victims behind ruins, the health sector as a more hygienic patient breathing monitoring and providing comfort for patients, and the military sector supports the recognition of enemies hiding behind walls.

Radar Frequency Modulated Continuous Wave (FMCW) has advantages such as the ability to detect multiple targets, better resolution range, simple transmitter architecture, and resistance to intercept. Efforts to increase the capability of the FMCW multi-target radar in identifying small displacement respirations continue to be developed. One of these efforts is to increase the ability of the transceiver device so that it can produce several antenna beam directions that can reach targets in different directions. Beamforming is a technique used to direct a beam array in a certain direction. Thus, all objects in different directions that are the same distance from the antenna receive nearly the same power level. Butler matrix (BM) is a beamforming method with advantages such as bandwidth capability, structural simplicity, and very low current consumption.

The purpose of this proposed research is to design a beamforming system using the Substrate Integrated Waveguide (SIW) technique for a single sensor-based 24 GHz FMCW radar that can improve the radar's reception capability in detecting small displacements (small displacement) breathing of several objects in one room. The use of SIW on millimeter waves has been proven to provide advantages from the transmission side.

Keywords: FMCW Radar, Beamforming, Butler Matrix, SIW