ABSTRACT

The rapid development of communication technology has driven the increasing demand for wireless network systems that are not only wide-ranging but also reliable and efficient. Antennas, as one of the essential components in long-distance communication systems, are also required to evolve in terms of both shape and function. One of the technologies widely used today is beamforming, which allows the signal to be directed specifically to reduce interference, improve signal quality, and enhance power efficiency. However, many conventional antennas still use radiation patterns that spread in all directions, causing power loss and making them susceptible to interference between users. On the other hand, the development of more complex antennas is often hindered by cost limitations and the availability of materials. The main problem in this research is how to design an antenna with adjustable signal direction without changing the shape or position of the antenna while maintaining cost-effectiveness and efficiency.

The proposed solution in this study is to design a microstrip switchbeam antenna operating at a frequency of 5.8 GHz, which can change the direction of signal radiation based on the activated input port. This design uses a Koch Island fractal patch made of copper and an FR-4 substrate, known for its cost-effectiveness and power efficiency. The antenna is designed with 4 ports combined using a 4:1 power combiner, resulting in 1 output port. This configuration is connected to RF switching to flexibly direct the radiation pattern through the activated port. The feeding system uses a combination of feedline and coaxial techniques. The device is designed using CST Studio Suite 2019.

The test results show that all antenna ports meet the return loss specification of below -10 dB, with the best value being -22.599 dB. The VSWR of all ports ranges from 1.160 to 1.235, indicating good impedance matching. The bandwidth achieved far exceeds the target, ranging from 1.096 to 1.192 GHz. The mutual coupling values are mostly below -20 dB, showing effective isolation between ports. Although the gain value has not fully reached the target of 6 dBi, the antenna's performance still shows results close to expectations. Overall, this switchbeam antenna patch fractal works well and meets most of the design specifications.

Keywords: antenna, fractal, microstrip, radiaton pattern, switchbeam.