

## ABSTRACT

The development of technological advances in the modern era is happening very rapidly, this is directly proportional with the use of very high data services. Communication service based on cellular is a major milestone for data service users. If there are more Cellular Users (CU), so it need a greater the spectrum resources and the speed of data rates.

Device to Device (D2D) is a technology that can work directly without passing through the evolved Node B (eNB) by reusing spectrum resources in the CU. Spectrum resources basically can only be used interchangeably by CU, therefore in this study will explain the allocation of spectrum resources so that they can be used simultaneously by dividing resources into several Resource Block (RB). However, this can cause interference between D2D users and CU. To overcome this, a simulation study of resource allocation in the downlink direction on the LTE network using the Particle Swarm Optimization (PSO) algorithm and the Random Allocation algorithm as a comparison.

The algorithm is tested in two scenario, that is the variation in the number of CU and the variation in the number of D2D. Then it bring up the values of spectral efficiency, energy efficiency, total data rate, and fairness. The achievement of this research is by using the PSO algorithm to obtain results from the spectrum of efficiency, energy efficiency, total data rate, and fairness that are better than the Random Allocation algorithm.

**Keywords :** Cellular User, Device to Device, Particle Swarm Optimization, Random Allocation.