

## ***Abstract***

*IEEE 802.15.4 / Zigbee is designed on the PHY and MAC layer to work at the level of low data rate and protocol design is not too complicated. On the utilization, Zigbee widely used for home automation, military, environmental monitoring, healthcare, and industrial, because Zigbee does not really need much energy. There are two techniques in the use of Zigbee network, the beacon enabled that uses slotted CSMA/CA technique, and the un beacon/beaconless enabled that uses unslotted CSMA/CA.*

*In this final task, the research focused on un beacon wireless sensor networks of IEEE 802.15.4 that simulated using NS-2 and then examined and analyzed the performance. The study starts from the description and viewed un beacon mode of MAC protocol in terms of collision avoidance techniques that uses technique unslotted CSMA/CA. The purpose of this study was to determine the good performance of the simulation, which can then be applied in real conditions.*

*The result show that, if the traffic density increases, the performance of the networks decreases. However, the throughput can be increased if the networks uses ACK mechanism. By using AA type alkaline batteries, sensor networks using star topology with the number of nodes 6 to 21 pieces, the batteries can last between 3to 9 months with consideration of the network does not use a specific routing protocol. BE parameter also affects the throughput if the network traffic congested, ie in the range 0,416 to 6,3232 kbps, but the energy consumed is also higher between 0,145 to 0,165 Joule. Besides, the higher macMaxCSMABackoffs also affect network performance when the network traffic congested, throughput range from 56,8256 to 57,5744 kbps, but also the higher energy consumption, between 2,5412 to 2,46123 Joule.*

**Keywords:** IEEE 802.15.4/Zigbee, PHY, MAC, slotted CSMA/CA, unslotted CSMA/CA, NS-2, energy, BE, macMaxCSMABackoffs.