Reducing the Environmental Impact From Mobile Telecommunication Networks

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During the last decades, mobile networks have continued to grow and are expected to grow even further with the introduction of Internet of Things and the next generation radio system named 5G. As the networks grow, energy efficiency and sustainability is becoming more and more interesting and necessary for the network operators. However, energy efficiency is an area often overlooked in favor of connectivity, throughput and availability when building mobile networks.

To see how we could increase the energy efficiency of radio units we studied both hardware and existing energy efficiency features to see if there were any possibilities to improve the current implementations. Due to our time limit we quickly realized we could not do any hardware changes in the means of changing components for more efficient ones, for example by introducing more efficient transistors in the power amplifier. Instead, our focus became trying to improve the current power save features that were implemented in the radio. We focused mainly on two features, one which during low traffic scenarios turns off one of the transmitter branches to save power, and one feature that basically powers down the radio when there is no need for the radio to transmit nor receive.

The focus on the features became trying to turn off excess components that were not used, but still powered on and consuming power. To do this we set up a complete end-to-end system with real mobile phones connected to a real base station which was based LTE technology. This gave us full control over the system to test the features and to control the radio unit.

A novel approach used to identify components that were consuming power was to look at the circuit board with a thermal camera to find hot spots, i.e. components that were consuming power. This helped us identify what we should focus on and proved to be good at visualizing the results. By the end of our work we managed to reduce the power consumption in the features by 36 % and 3.4 % respectively. We also created a model to show how new hardware and activation of power save features impacted the energy consumption of a realistic LTE network. It is shown in the model that by replacing old hardware by new modern hardware and activating and using power save features more often, the energy consumption can be reduced by up to 57 %.