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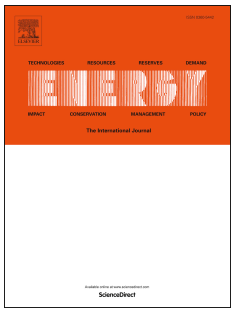

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Energy Saving in Green Wireless Communication by Dynamic Transmitter Shutdown Technique

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Abstract: Due to the increasing demand of wireless communication, the number of radio base stations has been growing excessively. The wireless network is designed for maximum traffic load, but the traffic load is unevenly distributed resulting in wastage of energy consumption most of the time during low traffic. Traditional energy saving techniques like switching off certain BSs completely during low traffic creates problems in restoring to optimum capacity when traffic increases. There is the potential of saving energy consumption along with maintaining quality of service and resulting environmental impact by introducing dynamic transmitter shutdown technique.

In this paper, an algorithm of dynamic transmitter shut down techniques during low traffic is proposed. The algorithm depends on automatically switching off unnecessary transmitter when the traffic is low and switching on required transmitter when the traffic starts to increase. With this technique, base stations dynamically adjust the number of transmitters to be enabled based on the user traffic and required channels without compromising the service quality. The measured results revealed that the proposed model reduces the energy consumption of base stations by up to 18.8 % as compared with the traditional static BSs, which is a step forward towards the implementation of green wireless communication.

Keywords - Energy consumption, Base stations, Energy saving, Measurement, Green communication

Abbreviations: BS, base transceiver station; ICT, Information Communication Technologies; TRX, Transmitter; RAN, Radio Access Network; MIMO, Multiple input multiple output; E3F, Energy Efficiency Evaluation Framework; DTST, Dynamic Transceiver shutdown technique; UMTS, Universal mobile telecommunication system; LTE, Long Term Evaluation; PA, Power Amplifier; AC, Alternate current; DC, Direct current; RF, Radio frequency; BSC, Base station controller; MS, Mobile Station; TCH, Traffic channel; SDCCH, Standalone control channel; BCCH, Broadcast control channel; PDCH, Packet data channel; HWFM, Holt-Winter's forecasting method; GSM, Global system for mobile communication; 3GPP, 3rd Generation partnership project.

1. Introduction

Telecommunication has become an indispensable part of people's daily life in today's global context. The number of mobile users grew exponentially during the last few years. Information Communication Technologies (ICT) industry is responsible for about 3 % of the world's total electrical energy. It is expected that the amount of energy consumption will grow to 1700 TWh by the end of 2030[1]. Moreover, the global footprint of CO_2 emission will increase by a factor of three between 2007 to 2020 rising about 235 Mton of CO_2 [2]. For example, a 3G BS produces an output power per carrier of 60 W and typical input power consumption ranges from 675 - 795 W. There are around 2,430 BSs in Nepal installed by Nepal Telecom, which consumes more than 14 GWh input power every year [3]. The carbon footprint from the wireless communication is also increasing exponentially, which indicates the important power issue. This shows that "Green Cellular Communication" deployment needs a primary focus on power consumption reduction in BSs [4].