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Array Antenna for Power Saving of Sensor Nodes in UAV-BS Enabled WSN

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Abstract In a wireless sensor network (WSN) consisting of a large number of sensor nodes (SNs) within a wide area, an SN may fall into outage level due to the low transmit power. This outage probability (OP) further increases due to a larger path-loss caused by long transmission link of SN at the edge of the area, and the decreased achievable signal to interference plus noise power ratio (SINR) caused by interferers. Due to the limited power of SNs, an energy-efficient communication scheme is crucial to prolong the network lifetime. To lower the OP and transmission energy, a rotational angle division multiple access (RADMA) is proposed. In RADMA, an unmanned aerial vehicle base station (UAV-BS) equipped with a uniform linear array antenna (ULA) is deployed as the fusion center (FC) of the WSN. The lobes of the ULA are exploited to form a *virtual sector*. To cover the whole communication area, multiple virtual sectors are created by rotating UAV-BS physically. By RADMA, the number of interferers can be decreased by limiting the number of active SNs that are within the virtual sector. Since the desired SNs are located within the virtual sector, the received signal can be enhanced by the high gain of the ULA. First, the OP performance of RADMA is evaluated analytically. In this manuscript, the closed-form expression of the OP is derived under a Rician fading. A convergence study is also presented to guarantee the validity of the derived closed-form expression. Finally, several simulation results are presented to validate the accuracy of the derived closed-form expression and the effectiveness of RADMA to lower the OP and the transmission energy.
Key words UAV-BS, WSN, array antenna.

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