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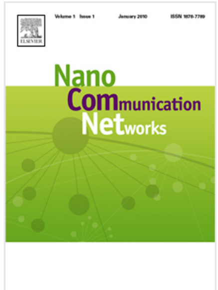

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Characterizing Terahertz Channels for Monitoring Human Lungs with Wireless Nanosensor Networks

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Abstract

We characterize terahertz wireless channels for extracting data from nanoscale sensors deployed within human lungs. We discover that the inhalation and exhalation of oxygen and carbon dioxide causes periodic variation of the absorption coefficient of the terahertz channel. Channel absorption drops to its minimum near the end of inhalation, providing a window of opportunity to extract data with minimum transmission power. We propose an algorithm for nanosensors to estimate the periodic channel by observing signal-to-noise ratio of the beacons transmitted from the data sink. Using real respiration data from multiple subjects, we demonstrate that the proposed algorithm can estimate the minimum absorption interval of the periodic channel with 98.5% accuracy. Our analysis shows that by confining all data collections during the estimated low-absorption window of the periodic channel, nanosensors can reduce power consumption by six orders of magnitude. Finally, we demonstrate that for wireless communications within human lungs, 0.1-0.12 terahertz is the least absorbing spectrum within the terahertz band.

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