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## Wireless Bio-Radar Sensor for Respiration Detection

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In this paper, a wireless bio-radar sensor was designed to detect a human heartbeat and respiration signals without direct skin contact. In order to design a wireless bio-radar sensor quantitatively, the signal-to-noise ratio (SNR) in the baseband output of a sensor should be calculated. Therefore, we analyzed the SNR of the wireless bio-radar sensor, considering the signal power attenuation in a human body and all kinds of noise sources. Based on these analysis and the measurement results, a compact, low-cost 10.525 GHz (X-band) bio-radar sensor was designed and implemented in a printed circuit board. The demonstrated sensor consists of two printed boards: a control board and an antenna board. Measurement results show that the heart rate and respiration accuracy was very high. Therefore, we verified that a wireless bio-radar sensor could detect heartbeat and respiration well without contact and our SNR analysis could be an effective tool to design a wireless bio-radar sensor.