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Air-borne and tissue-borne sensitivity of skin-radiation acoustic sensors

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Measurements of body sounds on the skin surface have been widely used in the medical field and continue to be a topic of current research, ranging from the diagnosis of the respiratory and cardiovascular diseases to the monitoring of voice dosimetry. These measurements are normally acquired by means of light-weight accelerometers and/or air-coupled microphones attached to the skin. Such recordings can be corrupted by air-borne sounds that are generated by the subject or by other sources of background noise. In this project, the sensitivity of various commonly used bioacoustic sensors to airborne sounds was evaluated and compared with their sensitivity to tissue-borne body sounds. To delineate the sensitivity to each pathway, the sensors were first tested in-vitro, and then on human subjects. The results indicated that in many cases the air-borne sensitivity is sufficiently high to significantly corrupt body sound signals. The effectiveness of different air-borne insulation devices was also evaluated. Spectral analysis showed that simple acoustic insulators (e.g., passive hearing protectors) provide significant attenuation within the range of frequencies of interest for most applications, particularly when using air-coupled microphones.