A Skin Patch Resonator: Characterization of the Fluid Volume Measurements

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INTRODUCTION:
Wearable technologies have gained a huge interest in recent years due to their advantages in the early diagnosis of medical conditions such as heart attack and peripheral artery disease.
Additionally, wearable technologies are an attractive solution in the medical field due to the wearable form factor and minimal required training for uses. As such, this study is investigating a wearable skin patch resonator for the measurement of fluid volume changes. Specifically, this study aims to characterize the sensitivity and dynamic range of the sensor response to changes in fluid volume.

PURPOSE:
The aim of this study is to investigate the skin patch resonant frequency response for the characterizations of the sensitivity and dynamic range of the fluid volume changes.

METHODS:
The wearable skin patch sensor is an open circuit resonator that is energized wirelessly via an external antenna placed within closed proximity. Once the resonator is energized via the external antenna, it develops its own electromagnetic field and measure the changes in fluid volume nearby. For this study, we used a vector network analyzer for the purpose of energizing the wearable sensor and collecting the S11 return loss. From the VNA, we measure the resonance frequency shift in terms of frequency in Hz and amplitude in dB. In this study, the characterizations of the skin patch sensitivity and dynamic range were performed by dynamically increasing the fluid
(H2O) volume inside a chamber and collecting the sensor response.

RESULTS:
The wearable skin patch sensitivity and dynamic range were characterized by changing the fluid volume increments inside a chamber. The result of this study illustrates that dynamic range of the square spiral shape can be detected up to 5 cm. Also, the dynamic range for the circle spiral shape can be detected beyond 7 cm. Furthermore, the sensitivity for both the square and circle skin patch sensors is 0.5 ml.

CONCLUSION:
In this study, we are able to characterize the sensitivity and dynamic range of the wearable skin patch sensor which will lead into future advancement in the measurement of fluid volume changes inside the human body.