Physiological Studies of Brain Signals Using a Wireless Neurosensing Diagnostic System

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Motivation

Brain implant technology can enable physical control restoration, early seizure detection, health status monitoring, etc.

Existing/current implants are restrained by:
1) Wired connections to/from implant.
2) Heat generated by the implant’s battery and excessive electronics.
3) Long-term reliability and sensitivity issues in fully-passive and wireless implementations.

Challenge: Can we detect brain signals fully-passively and wirelessly?

Proposed Fully-Passive and Wireless Transducer for Acquisition of Neuropotentials

- Fully-passive and wireless neurosensors to acquire brain signals inconspicuously.
- Integration of extremely simple electronics in a tiny footprint to minimize trauma.
- Acquisition of extremely low signals, down to 50μVpp.

This implies reading of most known and useful neuropotentials.

Transformational health-status monitoring by overcoming challenges with conventional neurosensors for a very wide range of applications (e.g., trauma assessment, epilepsy, seizure detection, etc).

Batteryless Implant

Typical neural signal power = -80dBm (50μVpp)

Technical Approach: New set-up demonstrates ~22dB improvement

- [1] 2.4GHz signal from exterior interrogator turns “ON” diodes.
- [2] Brain neuropotentials at fn = 0.5Hz-7kHz.

New set-up with anti-parallel diode mixers improves sensitivity by 22dB. Therefore, most human physiological neuropotentials can be recorded wirelessly.