

**Aufgabe der Diplomarbeit im  
Hauptstudium II****für:** Frau Natasa Penić**gestellt von:** Prof. Dr.-Ing. Klaus Solbach  
Fakultät für Ingenieurwissenschaft - Hochfrequenztechnik**Thema:** Optimization of an on-body antenna**Beschreibung:**

One technique to measure heartbeat rates is by placing an antenna on the body in the middle of the chest. A preliminary measurement using the vector network analyzer (VNA) is shown in figure 1. The measurement is based on a measurement of reflected microwave energy. The heartbeat and respiration rates affect the input impedance of the antenna when the human thorax occupies most of the antenna near field region. A good penetration of the electromagnetic energy into the body is important because reflected signals will be used for the determination of the heartbeat. Hence it is necessary to obtain a reasonable matching. The matching depends on the position of the antenna and the individual body structure.

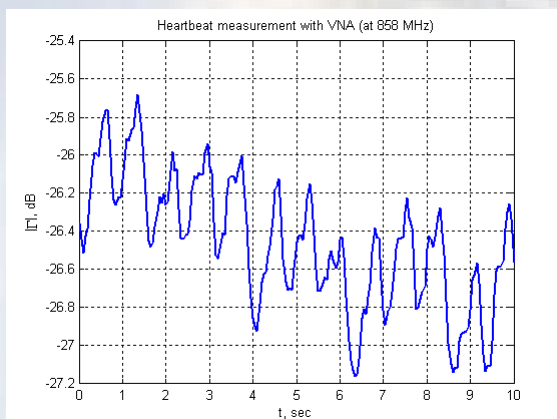


Figure 1: A preliminary measurement with the VNA

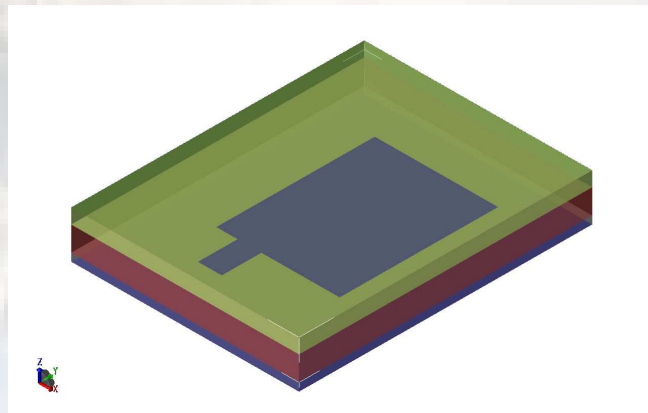


Figure 2: Stacked antenna design

**Task:**

The aim of the task is to decrease the influence of the human body and the positioning of the antenna on the operation of the heartbeat sensor. This can be obtained by introducing an air gap or a dielectric layer or a combination of both between the antenna and the human body (see figure 2).

In particular, the task entails the following steps:

1. Literature search on on-body antennas
2. Design and optimization of a patch antenna operating at 880 MHz using EMPIRE
3. Simulation and optimization of the stacked antenna using EMPIRE
4. Build the antenna and test the influence of the human body on the input impedance of the antenna
5. Measure the heartbeat rates of several individuals with the VNA

At the end of the work, a public presentation of results is to be given.