1. **Market Analysis**

The target market that our project focuses on is the 10000 health care providers and the 150 research institutions that utilizes EEG(intracranial and extracranial EEG) machines for research purposes. The market value with wireless EEG machine will be approximately $90 Million dollars with an annual projected revenue of $9 Million dollars.

The total market for EEG is divided into two market segments. Scalp EEG and Intracranial EEG operations. As discussed in Design Context Review document, scalp EEGs uses non-invasive electrodes that are stuck to the scalp of the patients. Scalp EEGs are generally for patient with less severe epilepsy symptoms and account for approximately 70% of the patients. Intracranial EEGs utilize implanted electrodes for better EEG readings, which involves a surgical procedure where the electrodes are buried underneath the scalp. The Intracranial EEG procedure is only used when the patient suffer from severe epilepsy and scalp EEG was unable to provide a clear reading of the brain pattern of the patient. Since the product that we are developing are focused on intracranial EEG applications, our target market segment is therefore the intracranial EEG market within the overall EEG market.

The Intracranial EEG market is then further divided into four components:

1. Hospitals
2. Clinics
3. Research Institutes
4. Household usages

Since our device is used for invasive medical monitoring procedure and the implantation of the probe requires surgical procedures, the product will not household usages.

As per research institutes, there are about 150 research institutes in America that engages in neuroscience research which would require intracranial EEG operations. In contrast, there are approximately 5686[13] hospitals and 4084 clinics[14] in America. Given the huge difference between sizes of the different market segments, the contribution of Research Institutes to our market size is negligible. Therefore, our main focus for market analysis is on Hospitals and Clinics.

Since EEG is a standard medical procedure for diagnosis of a spectrum of illnesses, it is reasonable to assume that each health-care provider - hospitals and clinics - will carry EEG machines. The amount of EEG machines per health-care provider is roughly estimated by the total number of EEG operations performed yearly in America. As reported, there are 10-25 Million EEG operations performed every year in the United States[15], which averages to around 17.5 Million operations/year. Given that there are around 10000 health-care providers which have the capability of performing such operations, the number of EEG operations performed per day per health care provider is simply calculated as (operations/day/provider). Given that health care providers generally purchase more EEG machines then they would normally require on a daily basis, we came to the assumption that a health-care provider, on average, has 8 EEG machines.

Some preliminary market research has shown that the average price for a medical EEG device is about $7500 dollar. Since number research institutes are comparatively small, their contribution to the total market value will be negligible as compared to the health-care providers. Finally, with the number of customers, total number of machines per customer and the unit price per EEG machine, we can calculate the total market value as follows:

The Total Market Value calculated by the above equation for our device will be $600 Million.

Research has shown that 1.1% of all EEG operations are intracranial EEGs[21]. This means each hospital will carry only 1 intracranial EEG machine. However, the previous assumption that each health-care provider will carry more devices than they absolutely require dictates that number of machine per health-care provider will be 2. Such reasoning will give us a new market value estimation of $150 Million.

Our customers, being hospitals and clinics, may be reluctant to adopt new technologies for two reasons:

1. High cost of medical devices,
2. Safety concerns.

Since medical devices are costly and updating devices usually take long review process (see Design Context Review), the willingness of our customers to purchase our products may be influenced by these factors. Nonetheless, we still expect the majority(at least 75%) of our total market to be willing to purchase our products for the following reasons:

1. Our product will be user-friendly (easy to implant and easy for data collection),
2. Our product will be wireless and therefore be convenient for patients,
3. Our product will be comparable in price with existing EEG machines.

Given that the product will provide a significant improvement over currently existing machines in terms of user friendliness, comfort and convenience and is of comparable price. The projected demand for our product is extremely promising and welcoming.

Analyzing the wireless neural recording market, we found that wireless intracranial EEG recording is a very new field with very few competitors. DEUTRON[16] is a medical device company that produces small wireless EEG recorders to medical research institutions. Their device, although much smaller than most of existing EEG recording machines, is still 24mm in length and relies on a miniSD card for data storage, meaning that the data collected will not be real-time. These two factors rendered it unsuitable for medical applications.

Another competitor currently in the field is the NEUROPACE[17]. Neuropace produces wireless EEG recording system that is implanted into the brain, similar to the purpose of our device. However, its product focuses on brain stimulation as treatment for epilepsy instead of brain monitoring which serves as a means of diagnosis. This means that the target customers of NEUROPACE will be fundamentally different from ours, as their products will be designed for patients instead of the physicians and health-care providers. More importantly, despite it being wireless, NEUROPACE’s products are still bulky and require large batteries to power, making it uncomfortable and potentially dangerous (large electricity reservoir poses considerable threat to brain functionality in the form of potential power leakage).

As shown above, the very few existing competitors in the market are either targeting different customers or are not developed enough for medical applications. Hence, we expect at least 80% of the projected customers to purchase our product, as it will be easier to use, lighter, smaller more accurate and more power efficient. Hence, the market value for our product, after accounting for competitions, will still be around $90 Million dollar. Since EEG machines have a lifespan of around 10 years on average, the projected annual revenue will be a handsome $9 Millions dollars.