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# Design of Button Antenna for Wireless Body Network using HFSS

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ABSTRACT

A design of a wearable antenna for WLAN applications is presented in this project. The antenna consists of a button shape outer cylindrical structure with different composites. The overall size and shape achieved are those of a standard metal jeans button which camouflages the antenna for wearable applications. The rigidness of the structure is greater than for previous wearable button antenna developments. The proposed wearable antenna is designed for 2.4 GHz and 5 GHz with monopole type radiation patterns at each band. This allows for transmission to other worn devices on the body. An investigation into the measured permittivity of cotton denim is presented and a section on the equivalent circuit modelling of the antenna and the fabric is given.

**Keywords:** Antenna, HFSS, Network, Communication System, Wireless Local Area Network.

## 1. INTRODUCTION

Antennas are very important component of communication systems. By definition, an antenna is a device used to transform RF signal, travelling on a conductor, into an electromagnetic wave in free space. Antennas demonstrate a property known as reciprocity, which means that an antenna will maintain the same characteristics regardless if it is transmitting or receiving. Most antennas are resonant devices, which operate efficiently over a relatively narrow frequency band. An antenna must be tuned to the same frequency band of the radio system to which it is connected, otherwise the reception and the transmission will be impaired. When a signal is fed into an antenna, the antenna will emit radiation distributed in space in a certain way. A graphical representation of the relative distribution of the radiated power in space is called a radiation pattern. A body area network (BAN), also referred to as a wireless body area network (WBAN) or a body sensor network (BSN), is a wireless network of wearable computing devices. BAN devices may be embedded inside the body, implants, may be surface mounted on the body in a fixed position Wearable technology or may be accompanied devices which humans can carry in different positions, in clothes pockets, by hand or in various bags. The rapid development of wearable computing systems is driving a need for suitable body antennas. Wearable antennas have been developed in the form of conducting micro strip patches of on textile fabric.

## 2. LITERATURE SURVEY

Antenna is composed of a button antenna structure. Button antenna is located on the top of the textile substrate and conductive textile ground. This antenna shows two types of radiation pattern, a omnidirectional radiation pattern in the 2.4GHZ band and broadside radiation pattern in the 5GHZ band. Thus both On and Off-body functions can be achieved. On body communication is used for suppressing the unwanted radiation away from the body and Off-body communication is used for reducing the backside lobes.

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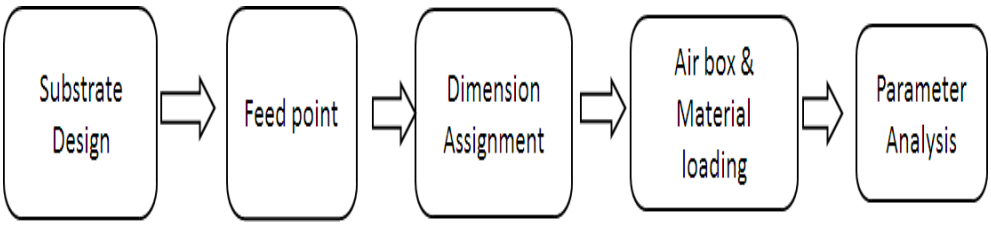
This area relies on the feasibility of implanting very small biosensors inside the human body that are comfortable and that don't impair normal activities. The implanted sensors in the human body will collect various physiological changes in order to monitor the patient's health status no matter their location. The information will be transmitted wirelessly to an external processing unit. This device will instantly transmit all information in real time to the doctors throughout the world. If an emergency is detected, the physicians will immediately inform the patient through the computer system by sending appropriate messages or alarms. Currently the level of information provided and energy resources capable of powering the sensors are limiting.

## 3. PROPOSED SYSTEMS

A design of a wearable antenna for WLAN applications is presented in this project. The antenna consists of a button shape outer cylindrical structure and an internal central via connected to a top disc at one end and the metal ground plane at the other. The overall size and shape achieved are those of a standard metal jeans button which camouflages the antenna for wearable applications. The rigidness of the structure is greater than for previous wearable button antenna developments. In our project, we propose a dual-band dual-mode button antenna for body centric communications. On-body communication is used to suppress the unwanted radiation away from the body and Off-body communication is used to reduce the backside lobes on the textile fabrics.so that we use this both communicate radiation mode for designing the button antenna using HFSS software system.

## 4. PROPOSED BLOCK



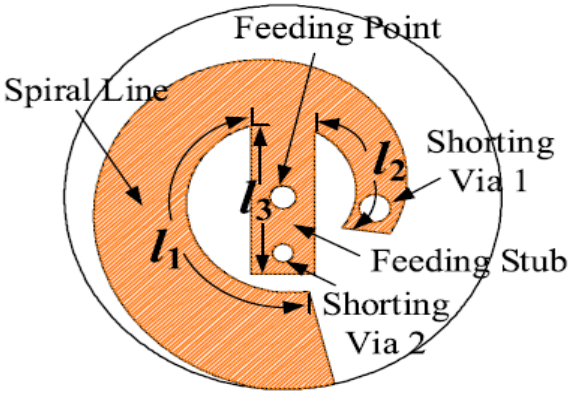



**Figure:1** Proposed Structure

### *4.1 ANTENNA DESIGN*

The above figure shows that the proposed structure of the button antenna. Antenna consists of a spiral line including long part L1 and short part L2 and feeding stub L3. Dimensions of the long part L1 is 11mm and short part L2 is 5.6mm and feeding stub L3 is 6.3mm.Feeding point is used to taken the wire from the antenna. Two shorting vias are loaded at the end of the spiral line and feeding stub. Antenna is made by circular roggers 4003.First step of the proposed block is to designing the basic substrate and followed by tokening the wire from the antenna and then dimensions is used to check the parameter such as return loss, input impedance, gain and magnetic permeability. And further followed by air box is to use to avoiding the disturbance automatically due to correct dimensions and at least analysis the parameters.

### *4.2 ANTENNA CHARACTERISTICS*

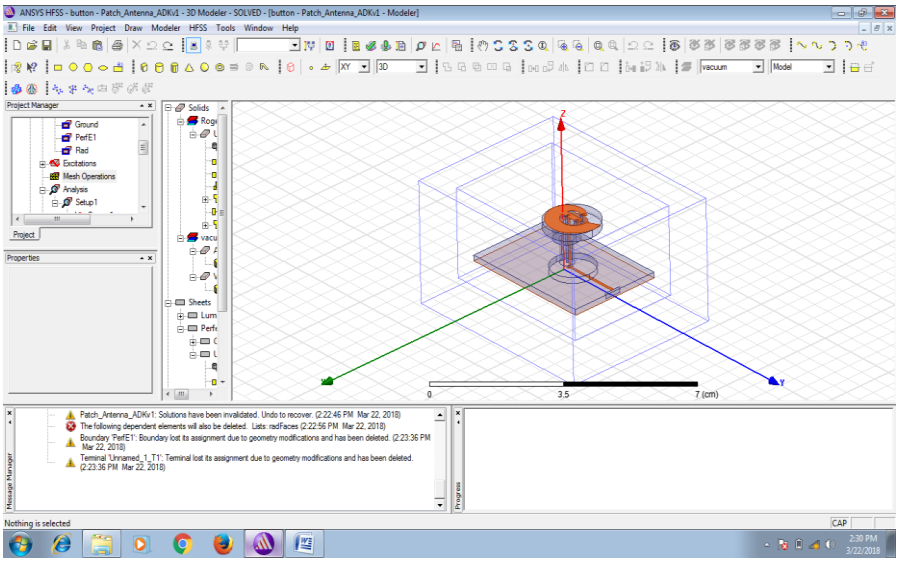
a. Input Impedance
b. Return loss
c. Bandwidth
d. Directivity and Gain
e. Radiation Pattern
f. Beam width

### *4.3 MEANING FOR ON AND OFF BODY*

Off body away from body surface on body human body consider as substrate. For off-body scenarios the propagation direction points away from the human body. The matching and the radiation pattern of the respective antennas may change due to the interaction with the human body but in general no modifications of the far field model are necessary. From an electromagnetic point of view the human body consists of a large number of lossy dielectric materials of various combinations and spacial arrangements. In case of an in-body scenario the antenna is integrated into this complex dielectric structure and along an arbitrary propagation path various electromagnetic propagation effects occur

## 5. RESULTS AND DISCUSSION

### *5.1. ANTENNA SOFTWARE DESIGN*

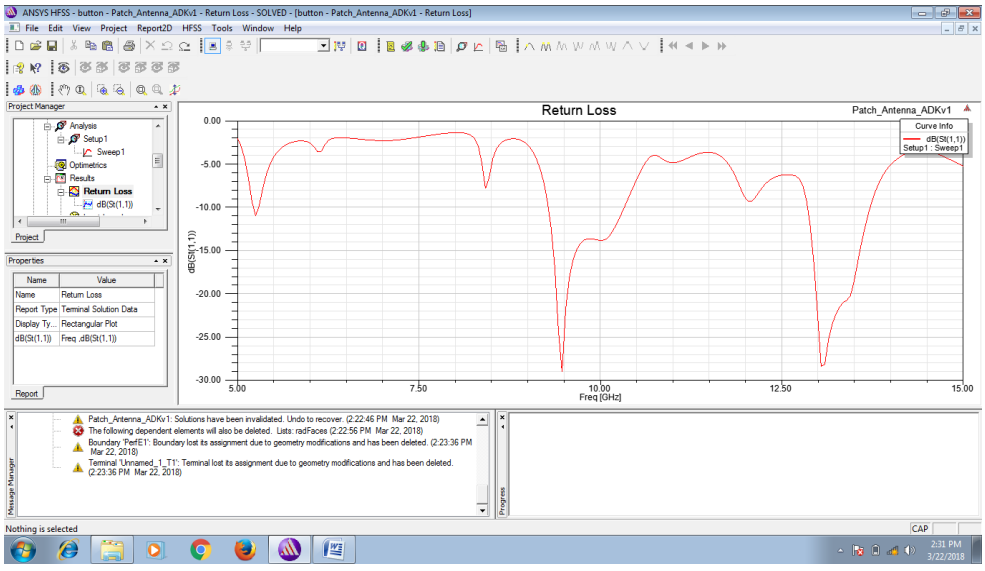


### *5.2. RETURN LOSS*

The return loss is another way of expressing mismatch. It is a logarithmic ratio measured in dB that compares the power reflected by the antenna to the power that is fed into the antenna from the transmission line. The relationship between SWR and return loss is the following:

$$\text{Return Loss (in dB)} = 20\log_{10}\frac{\text{SWR}}{\text{SWR}-1}$$

For an efficient transfer of energy, the impedance of the radio, of the antenna and of the transmission cable connecting them must be the same. Transceivers and their transmission lines are typically designed for 50 Ω impedance. If the antenna has an impedance different from 50Ω, then there is a mismatch and an impedance matching circuit is required.

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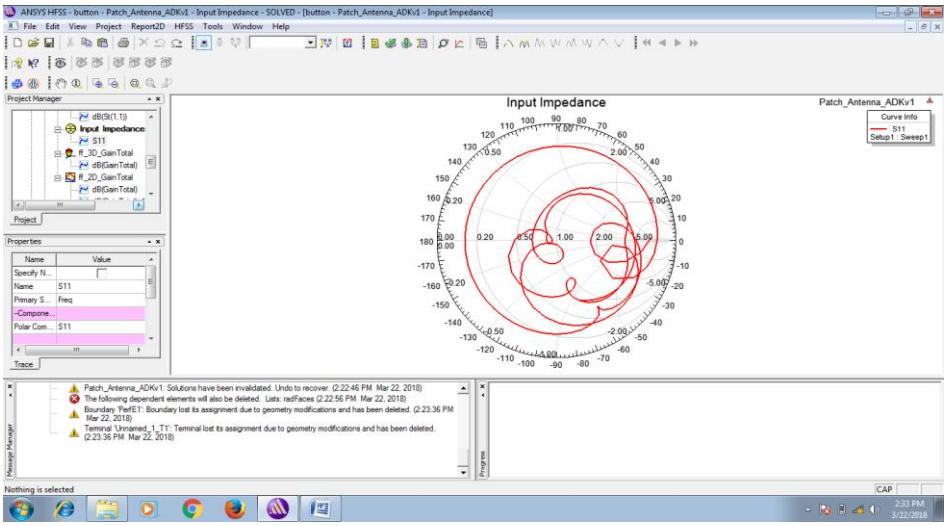
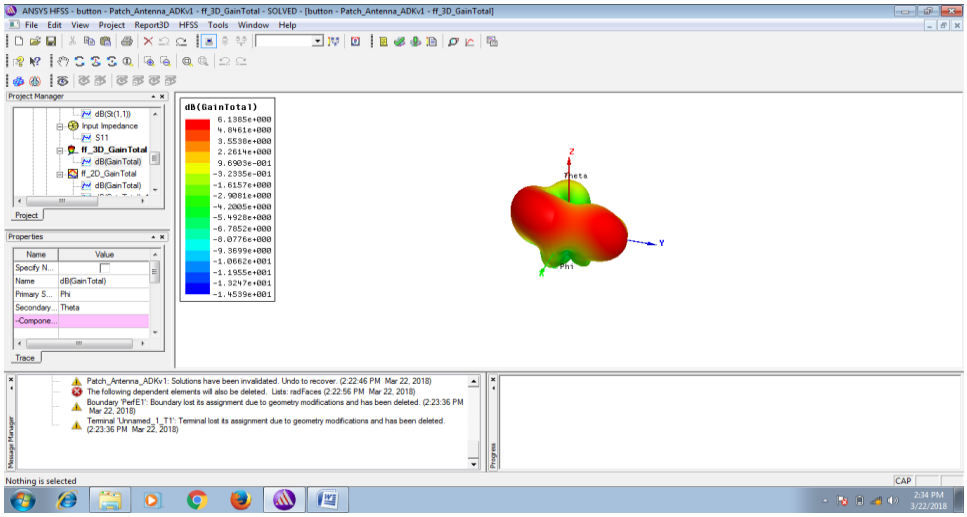
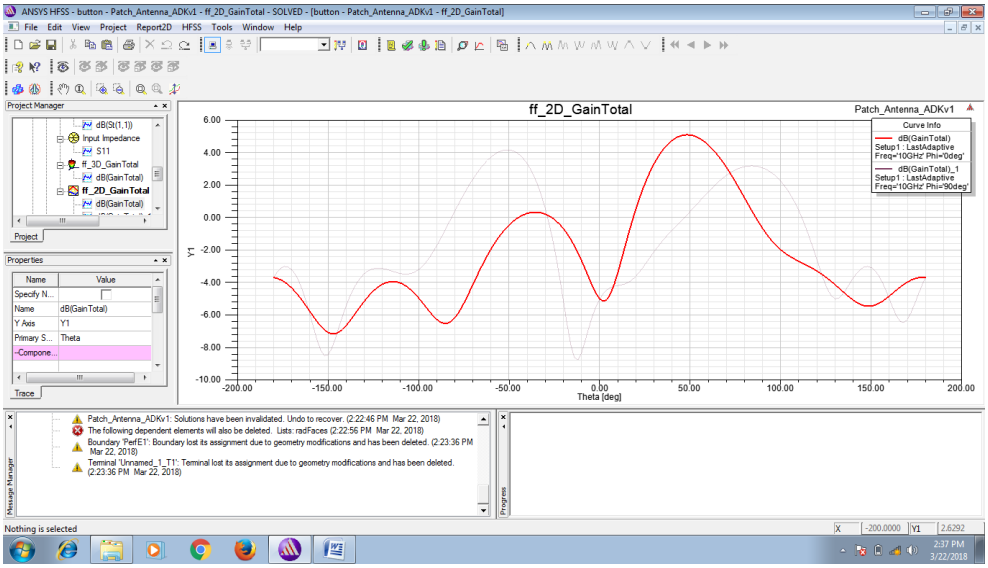
### *5.3. INPUT IMPEDANCE*




### *5.4. FF 3D GAIN*




### *5.5. FF 2D GAIN*

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### *5.6. ANTENNA HARDWARE DESIGN*

The bottom circular portion is metal flange, it is used for avoiding the crumpling and bending on the textile fabric. Central portion is called as coaxial feeding, it comprises copper pin passes through the hole of the metal flange to the feeding point. Top layer of the portion is called as designing of the button antenna.

## 6. CONCLUSION AND FUTURE WORK

Due to the increasing need for mobile communications in for example portable health care, sports monitoring, etc., wearable devices have received major attention during the last decade, in a multitude of operating bands like WLAN, WBAN,UWB etc A new type of dual-band button antenna for WLAN higher frequency applications was proposed, simulated and measured. The proposed antenna features a very compact size, a good and robust dual operating bandwidth performance, and stable far-field characteristics. Our proposed antenna can be used for on-body and off-body communication.

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