Novel Multiband Microstrip Loop Antenna for Wearable Applications

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Abstract: Multiband microstrip loop antenna with single shorting pin for wearable purpose is proposed. An antenna is efficient to operate in four different bands that includes Medical Implant Communication Service (MICS) (402-405 MHz), Industrial Scientific Medical (ISM) (2.4-4.8 GHz), Global System for Mobile communications (GSM) (975-1023 MHz) and Communication band (3-30 GHz). The Computer Simulation Technology (CST) simulator which can simulate electromagnetic signals and solve electromagnetic problems from Low frequency based on Finite Integration in Technique (FIT) is used for the design. The proposed antenna is designed for on body application that will radiate at MICS, ISM, GSM and Communication bands with very low reflection loss.

Indexed terms: On body communication, MICS, ISM , GSM, CST tool

I.INTRODUCTION

Antennas are very much essential components of all equipment that are using radio. They are widely used in Different types of communication systems. Antenna consists of an arrangement of number of conductors and they are connected electrically to the transmitter or receiver. An oscillating current of electrons imposed through the antenna by a transmitter will create an oscillating magnetic field around the antenna elements, while the charge of the electrons will also create an oscillating electric field along the elements and these time-varying fields discharge away from the antenna into space as a moving transverse electromagnetic field wave. There are many types of antennas are used for various purpose of communication. As compared with conventional antennas the microstrip patch antennas have more advantages. Microstrip patch antenna has patch which is conducting in nature. Here, we are designing the Microstrip patch antenna for On-body communication. Microstrip or patch antennas are becoming increasingly useful because they can be printed directly on to a circuit board. Microstrip antennas are becoming very widespread within the mobile phone market. Patch antenna are low cost, have a low profile and easily fabricated.

Body-centric wireless communication consists of on-body, off-body and in-body communication. On-body communication means, accurate monitoring has become extensive research area in recent days and communication between on-body/wearable devices. Off-body communication can be defined as communication with external networks. In-body communication means the antenna is being implantable into the body. This uses radio frequency signal as a carrier for modulation, and uses the wireless communication to share the data about body parameters like temperature, blood pressure etc.. of the human body.

Wireless communication generally works based on electromagnetic signals that are transmit by an enabled device through the air, physical environment or atmosphere. To design antenna for body-centric wireless communication it associated parameters like frequency bands, Bandwidth, Materials used in antenna fabrication, design approaches and performance. Implantable Medical Devices (IMDs) have the capability to communicate wirelessly with an external device. They are specifically operable for lower frequencies that they should be capable of communication with the equipment's and devices that are outside/external. These IMDs are receiving great attention for obtaining both real time and stored physiological data in biomedical telemetry. A differentially feed implantable antenna worked at two near bands (MICS band and ISM band) . The size of the differentially feed implantable antenna is a little large. A small-size differentially feed implantable antenna was designed for the MICS band and the ISM band..For this purpose, Medical Implantable Communication Service (MICS) (402-405 MHz) and Industrial Scientific and Medical (ISM) (2.4-4.8 GHz) are used. And also we can use two more bands like GSM and Communication band for communication purpose. The antenna operates at four frequencies that induce the return loss is less. Return loss is the loss of power in the signal returned/reflected by a discontinuity in a transmission line or optical fiber. It is a quantity of often used within the RF circuits, where impedance matching is important. The return loss is the proportion of a signal that is reflected as a result of an impedance mismatch. S-parameters describe the input-output relationship between ports.S11 means transmitted and delivered at the same port i.e., port 1.If S11= -10dB this implies that if 3dB of power is delivered to the antennas,-7dB is the reflected power. The frequency that operates less than -10dB means it produces low return loss. The CST software which is used to simulate the antenna design.CST offers accurate, efficient computational solutions for electromagnetic design and analysis. Our 3D EM simulation software is user-friendly and enables you to choose the most appropriate method for the design and optimization of devices operating in a wide range of frequencies. The proposed antenna has been designed for on-body communication in human body. The designed antenna is being aimed to be utilized on skin as well as inside the body.

II.LITERATURE SURVEY

A wearable antenna device is proposed or design as a replacement for existing continuous monitoring systems. Different shapes of antennas are designed for several uses in medical field .The literature shows that the spiral shape is the most optimal shape for medical purpose. So, antenna is designed positively to resonate around the frequency band that is around 402-405MHz (MICS) band and 2.4-4.8 (ISM) bands reserved for medical and industrial use, respectively. So, the antenna parameters are optimized to radiate at MICS and ISM bands .Figure1 shows the design having 22.5mm square shaped antenna with 2.5mm thickness.Figure2 shows the simulation results of respective antenna design.