

DESIGN AND SIMULATION OF MIMO PATCH ANTENNA IN WEARABLE GLASS FOR GPS/WLAN/WIMAX

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ABSTRACT:

In this design, wide band frequency is placed in a reconfigurable antenna that has three switchable states including an ultra wideband and other frequency band state. In a one triple band state is presented which includes all other frequencies used in wearable antennas. A micro strip line-fed antenna with two quarter wavelength slots of different lengths with stubs .E-shaped stub has it radiate at 2.5 to 6 GHz, is used as an antenna element. Hexagonal shape substrate has selected structure it can operate over wide bandwidth and has good radiation characteristics. Here the patch is designed and such that the patch is placed in front of hexagonal substrate and L-shaped slot is placed at bottom of the substrate. This helps wide band state, yields an impedance bandwidth of 2.54 to 11.71 GHz with return loss $S_{11} < -10$ dB. The three narrowband states, antenna operate over impedance bandwidth of 2.34 to 2.74 GHz, 3.71 to 3.97 GHz, 12.32 to 14.32 GHz with return loss $S_{11} < -10$ d. single triple band state antenna operate over impedance bandwidth of 2.47 to 2.66 GHz & 3.94 to 4GHz.

Keyword: Microstrip patch antenna, Google glass, CST software.

INTRODUCTION:

Today's mobile communication systems demand increased bandwidth for voice and data applications. The wireless communication systems, multiband antenna plays an important role for wireless service requirements. Microstrip patch antenna structure are the most common option used for the miniature designing of antenna. Microwave, radar and other communication purposes are uses microstrip antenna. Within this operating range of frequency, the antenna should have stable response in terms of VSWR, radiation pattern and s-parameter etc. Multiband antennas cater to these needs by radiating at specific discrete frequencies only. Designing multiband antennas of which the most important techniques are etching slots on the radiating patch or the ground plane. A compact tunable hexagonal patch antenna with slots etched in the patch in order to reduce its size and increase the radiation pattern. Microstrip patch antenna consists of a dielectric substrate, with a ground plane on the other side. Due to its advantages such as low weight, low profile planar configuration and capability to integrate with micro wave integrated circuits technology, the microstrip patch antenna is very well suited for applications such as wireless

communication systems, cellular phones, pagers, radar systems and satellite communication systems.

1.GOOGLE GLASS:

Wearable Antenna are essentially any antenna that is specifically designed to function while being worn. Our goal is to compare the free space antenna efficiency with that of the antenna efficiency in the presence of an absorbing material. Firstly, the VSWR of the antenna are measured across a frequency range of 1GHz to 6GHz. When an antenna is used as a wearable antenna, the body obstructs about half of the field of view for the antenna. This makes GPS performance on wearable devices particularly challenging. The wearable antenna always uses high bandwidth for good connection establishment. The proposed antenna is dually polarized. The printed dipole and the slot antenna provide dual orthogonal polarizations.

2.SOFTWARE SIMULATION – CST

CST is specialist tool for 3D EM simulation of high frequency component. CST MWS enables the fast and accurate analysis of high frequency devices such as antenna filters, couplers, planar multilayer structure and SI and EMC effects. It integrates simulation, visualization, solid modeling, and automation in an

easy-to-learn environment where solutions to your 3D EM problems are quickly and accurately obtained. CST employs the Finite Element Method (FEM), adaptive meshing, and brilliant graphics to give you unparalleled performance and insight to all of your 3D EM problems. CST can be used to calculate parameters such as S Parameters, Resonant Frequency, and Fields[6-10].

3.PROPOSEDSYSTEM:In proposed design, implementing passive elements to configure the antenna into different operating modes. These antennas achieved by multiband operations .FR-4 glass epoxy is a popular and versatile high-pressure thermoset plastic laminate grade with good strength for absorbing radiation and energies.The three narrowband states , antenna operate over impedance bandwidth of 2.34 to 2.74 GHz , 3.71 to 3.97 GHz , 12.32 to 14.32 GHz with return loss $S_{11} < -10$ d. The antennas far field , s-parameter. In this design, wide band frequency is placed in a reconfigurable antenna that has three switchable states including and an ultra wideband and other frequency band state. In a one triple band state is presented which includes all other frequencies used in wearable antennas. The single triple band state antenna operate over impedance bandwidth of 3.5 to 4GHz. It is capable of working in 4 frequency bands and for 3 applications as built in by one antenna. The miniaturization is done in various inverted-U-shaped radiator with additional I-shaped and L-shaped strips designed optimistically to achieve the minimal return loss over the four bands of frequency spectrum.

4.DESIGN CALCULATION:

4.1 Design calculation:

Step 1: Calculation of the Width (W): The width of the Microstrip patch antenna is given by following equation:

$$W = \frac{c}{2 * f_r} \sqrt{\frac{2}{\epsilon_r + 1}}$$

Step 2: Calculation of Effective Dielectric Constant (ϵ_{eff}): The following equation gives the effective dielectric constant as

$$\epsilon_{eff} = \frac{\epsilon_{r+1}}{2} + \frac{\epsilon_{r-1}}{2} \sqrt{1 + 12 \frac{h}{w}}$$

Step 3: Calculation of Effective Length (effL): The effective length is given as

$$L_{eff} = \frac{c}{2 f_r \sqrt{\epsilon_{eff}}}$$

Step 4: Calculation of the Length Extension (ΔL): Equation below gives the length extension as:

$$\Delta L = 0.412 h \frac{(\epsilon_{eff} + 0.3) \left(\frac{w}{h} + 0.264 \right)}{(\epsilon_{eff} - 0.258) \left(\frac{w}{h} + 0.8 \right)}$$

Step 5: Calculation of Actual Length of Patch (L): The actual length of the antenna can be calculated as:

$$L = L_{eff} - 2 \times \Delta L$$

5.MICROSTRIP HEXAGONAL ANTENNA:

A microstrip antenna consists of a metallic pattern on one side of a dielectric substrate and groundplane on the other side of the substrate. Microstrip antennas can be divided into two basic types by structure, namely microstrip patch antenna and microstrip slot antenna both have been used .The patch have been in front and the slot at the bottom. The patch in the antenna is made of a conducting material Copper (Cu) and this can be in any shape like rectangular, circular, triangular, elliptical or some other common shape. The hexagonal patch antenna is designed so as it can operate at the resonant frequency. The important parameters for the design of a Hexagonal microstrip patch antenna are frequency of operation, Dielectric constant of substrate and Height of the substrate. Hexagonal patch antenna structure shown in fig1.

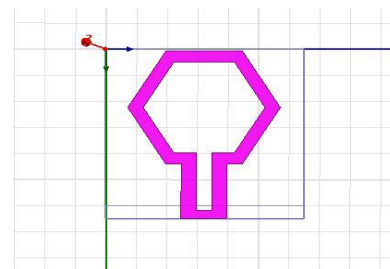


Fig 1:Antenna structure

The hexagonal patch antenna was designed with respective dimension.

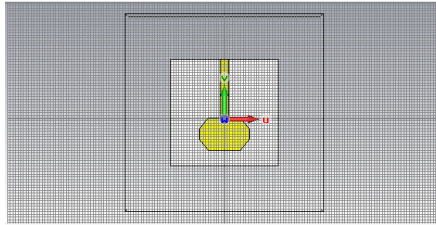


Fig 2:front view of hexagonal patch antenna

The hexagonal patch, slot and substrate are made up of copper substrate which are connected to ground, the back view of hexagonal patch antenna in fig3.

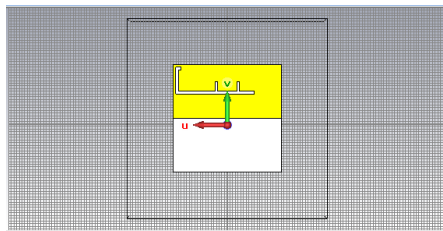


Fig 3:back view of hexagonal patch antenna

Table(1)

Parameter for antenna design:

PARAMETERS	DIMENSION
Substrate length	40mm
Substrate width	20mm
Substrate height	1mm
Dielectric constant	3.5mm
Patch length	8mm
Patch width	19mm
Input impedance	10ohms
Time slot	5mm

6.SIMULATION RESULTS:

Here antenna is simulated with hexagonal shape. The result was simulated using CST (Computer Simulation technology).Antenna parameter like

Return loss (S11), Bandwidth (MHz), gain and VSWR (Voltage Standing Wave Ratio) are analyzed.The parameter and construction of antenna is shown in Table(1).

A) S Parameter for hexagonal patch antenna

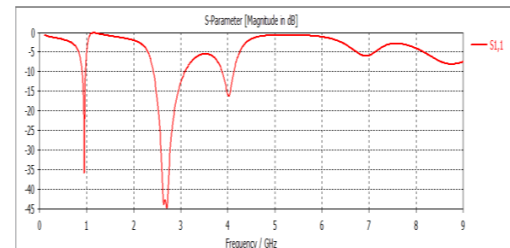


Fig5: S Parameter of hexagonal patch antenna

B) VSWR for hexagonal patch antenna

It is also measure of mismatch between the load and transmission line. The larger impedance mismatch, the larger the amplitude of the standing wave. It is not more than 2.VSWR was defined as ratio of the maximum voltage to the minimum voltage in standing wave. The VSWR can be represented by $VSWR = V_{max}/V_{min}$, the signal plot is shown in fig 6

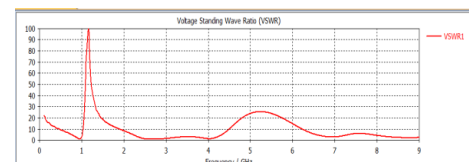


Fig 6: VSWR of hexagonal patch antenna

C)Power signal of hexagonal patch antenna:

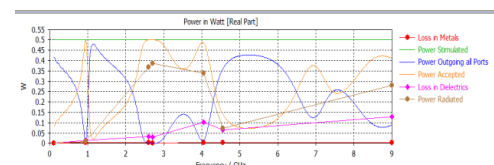


Fig 7:Power signal of hexagonal patch antenna

D)Radiation pattern:

Radiation pattern refers to the directional dependence of the strength of radio waves from antenna or other

source. The farfield of radiation pattern consists of theta and phi respectively which are shown in fig 8.

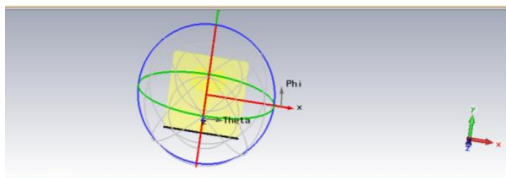


Fig 8: Radiation pattern of hexagonal patch antenna

CONCLUSION:

Hexagonal micro strip patch antennas with microstrip line feed are designed and simulated using CST 14.0, after that performance measures such as return loss, peak gain, VSWR, axial ratio and radiation pattern are observed. Linear and circular polarizations are obtained by changing the dimensions of a rectangular slot. These antennas achieve multiband operation with switch circuits operation on various bands maintained over it. These are frequency band are achieved while simulating the antenna. Here wearable antenna are used in google glass application.

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