Design And Analysis of Dual Port UWB Flexible MIMO Antenna for High Speed Multimedia Communication

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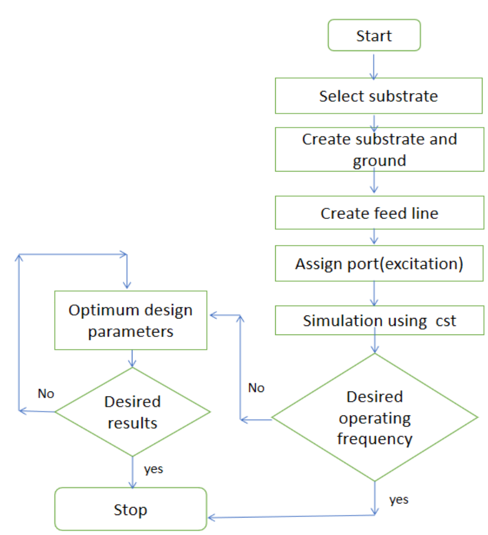
***Abstract*-This work presents Flexible Dual-band two port MIMO antenna with UWB Characteristics for high-speed Multimedia communication. These are printed on a thin, flexible Teflon substrate with εr = 2.55, and h = 0.8 mm. It has been possible to achieve frequency at 2.4 GHz to 12.8 GHz. The proposed antenna performs well in terms of bandwidth, peak gain, efficiency, and reflection coefficient. By positioning the two single-element antennas (42.5 × 30 × 0.87 mm^3) orthogonally to each other, the single-element antenna is upgraded to a MIMO antenna with an overall dimension of 90 x 42.5 x 0.87 mm^3 in total.**

Key words: Single element antenna, mimo antenna (multiple inputs multiple output antenna), Ultrawideband, and Multimedia communication

I. INTRODUCTION

In 2002, the US FCC allocated an unlicensed band from 3.1 GHz to 10.6 GHz on the frequency spectrum for UWB applications. Hence, up to 7.5 GHz of bandwidth is required for a workable UWB antenna. MIMO is an antenna technology for wireless communications in which multiple antennas are used at both the transmitter and the receiver. The antennas at each end of the communications circuit are combined to minimizeerrors, optimize data speed and improve the capacity of radio transmissions by enabling data to travel over many signal paths at the same time. MIMO is often used for high-bandwidth communications where it's important to not have interference from microwave or RF systems. The huge bandwidth of a UWB system, typically covering the spectrum from 3.1 to 10.6 GHz, allows many interesting applications. In terms of communications this results in very high data rates. In terms of radar high accuracy is achieved and thus a precise localization [1], [2]. Particularly in the case of radar, the use of polarization diversity allows to obtain further information about the object (target) characteristics, for instant the surface structure [2]. Apart from orthogonal polarizations, further conditions for the (radar) antenna design are a high gain and a common phase center (for both polarizations). A common antenna for such an application is the so-called Vivaldi antenna. The radiation mechanism is based on exponentially tapered slots and the traveling wave principle [3]. This type of antenna has a convenient time domain behavior as shown in [4] and a relatively stable radiation pattern in the hole frequency range. Since as for UWB systems the power spectral density is limited to -41.3 dBm/MHz, only short-range applications as given in indoor scenarios are feasible. For an indoor use, there has to be found a trade of between the directivity of an antenna and the distance which fulfills the far field conditions. Both are related to the aperture of the antenna. Antenna integration into a dielectric allows the reduction of the physical size of the antenna, since due to the higher permittivity the effective wavelength is smaller then in free space (air) [5].

II.FLOW CHART



III.LITERATURE SURVEY

Comparative Analysis of the reported antennas designed using flexible substrates

Ref.	Substrate	Operating band (GHz)	Bandwidth (GHz)	Dimensions (mm³)	Gain (dBi)	Efficiency (%)
1.	Kapton	1-8	155	48 x 35	3.1	NR
2.	Polyimide	1.4-16	167	52 x 37	>2.8	NR
3.	RT/duroid 5880	3.14–11.53	114	30 × 25	5.25	91
4.	Teslin	2.9–11.8	121	42 × 40	4.1	90

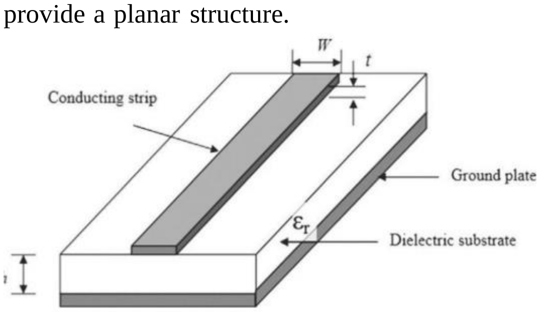
Due to increasing the utilization of smart phones, mobile phones, and portable devices wireless.

IV. MICROSTRIP PATCH ANTENNA

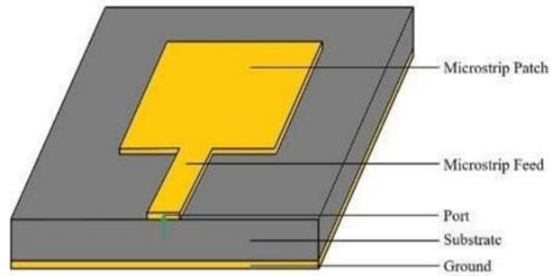
The Microstrip patch antenna has a dielectric substrate with a radiating patch and the feed lines are etched on one side and a ground plane on the other side as shown below. The shape of the patch is not constrained (could be square, rectangular, circular, triangular or elliptical) and it is generally made of conducting material such as copper or gold. The fringing fields between the patch edge and the ground plane cause the microstrip patch antennas to radiate. A better performance in the antenna calls for a thick dielectric substrate having low dielectric constant which provides better efficiency, larger bandwidth and better radiation.

FEEDING TECHNIQUES:

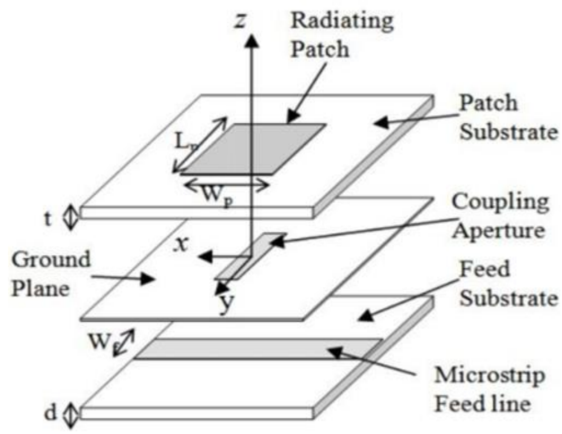
A)Microstrip Line Feed: Here a conducting strip, which is smaller in width as compared to the microstrip patch, is connected directly to the edge of the patch as shown in Fig. The major advantage is that the feed can be etched on the same substrate to provide a planar structure.

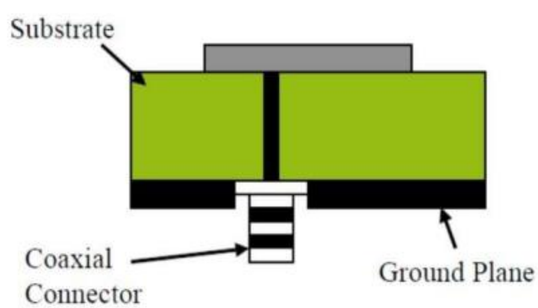


B)Aperture Coupled Feed: Here a ground plane as shown in Fig separates the radiating patch and the microstrip feed line and the coupling between both of them is made through a slot or an aperture in the ground plane. The coupling aperture is usually centred under the patch as the symmetry in the configuration results in lower cross- polarization.

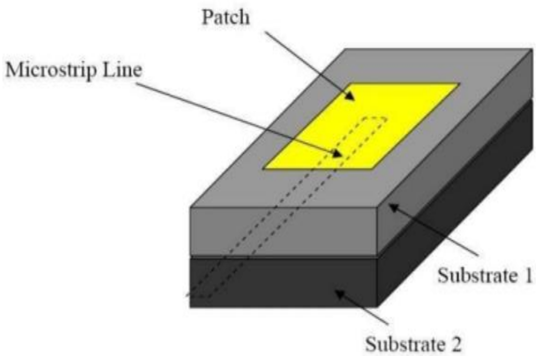


C)Coaxial Probe Feed: A common technique used for feeding Microstrip patch antennas is coaxial feed or probe feed. The outer conductor of the coaxial connector is connected to the ground plane and the inner conductor is extended through the dielectric and is soldered to the radiating patch. The feed can be placed at any desired location inside the patch in order to match with its input impedance as shown in figure.





D)Proximity Coupled Feed: This type of feed technique is also called as the electromagnetic coupling scheme. As shown in Fig.,two dielectric substrates are used such that the feed line is between the two substrates and the radiating patch is on top of the upper substrate. The main advantage of this feed technique is that it eliminates spurious feed radiation and provides very high bandwidth (as high as 13%), due to overall increase in the thickness of the microstrip patch antenna.

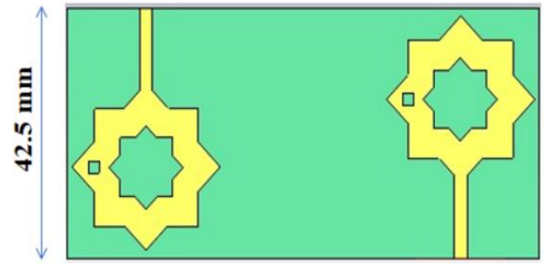


V. MIMO TECHNOLOGY

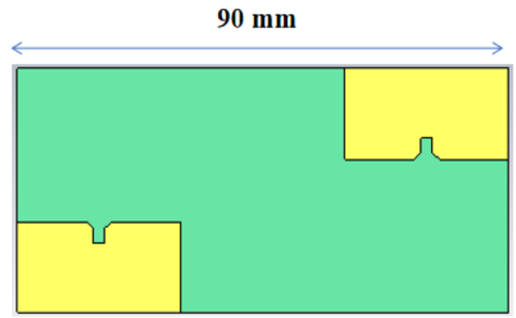
Multiple-input-multiple-output technology has attracted attention in modern wireless communication systems. A significant increase in channel capacity is achieved without the need of additional bandwidth or transmits power by deploying multiple antennas for transmission to achieve an array gain and diversity gain, thereby improving the spectral efficiency and reliability.MIMO antenna systems require high decoupling between antenna ports and a compact size for application in portable devices. MIMO uses multiple antennas on both the transmitter and receiver. They have dual capability of combining the SIMO and MISO technologies. They can also increase capacity by using Spatial Multiplexing (SM). The MIMO method has some clear advantages over Single-input Single-output (SISO) methods. The fading is greatly eliminated by spatial diversity; low power is required compared to other techniques in MIMO. The basic building blocks of a MIMO system.

VI.PROPOSED DESIGN AND ITS EVOLUTION

Modern communication systems progressively rely on Ultra-Wideband (UWB) antennas because of their capacity to send and receive signals across a broad frequency range with high speed. The growing need for wearable technology has resulted in a significant demand for flexible antennas. This works presents a flexible low-profile UWB antenna for wearable applications.

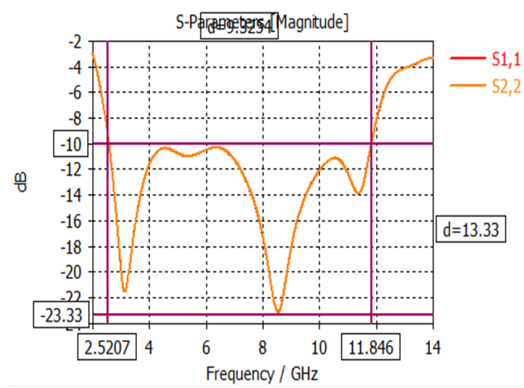


(a)top-layer

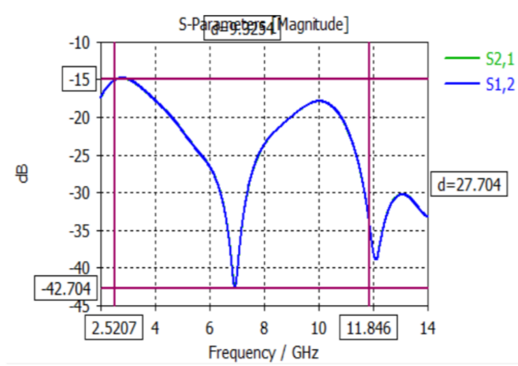


b)bottom-layer

VII.PROPOSED DESIGN RESULTS



S11–parameters



S21 –parameters

VIII.PERFORMANCE COMPARISION

Ref.	Substrate	Operating band (GHz)	Bandwidth (%)	Dimensions (mm^3)	Max. Gain (dBi)	Max. Efficiency (%)
1.	Kapton	1-8	7.77	48 x 35	3.1	NR
2.	Polyimide	1.4-16	15.85	52 x 37	>2.8	NR
3.	RT/duroid 5880	3.14–11.53	11.177	30 × 25	5.25	91
4.	Teslin	2.9–11.8	11.470	42 × 40	4.1	90
Proposed	**Teflon**	**2.55-11.9**	**11.899**	**42.5 x 30**	**5.26**	**>95**

IX.CONCLUSION

This work proposed a flexible MIMO antenna for the high-speed Multimedia communication that is integrated with jeans substrate. The antenna's top side, which is responsible for radiation, has a monopole structure. The two port UWB compact flexible antennas are designed and their performances are evaluated for high-speed Multimedia communication. The antennas are placed close to the human body in order to validate their conformal nature and flexibility for SAR measurement.

It can be concluded that, Based on the simulation results, it can be concluded that, the proposed antenna has a compact size with a simple configuration, and it operated at 2.55 to 11.9 GHz, which covers UW band with radiation efficiency of > 95%, and higher bandwidth, where VSWR is less than 2 and the return loss is better than -10 dB. Therefore, the proposed antenna can be operated with good performance at the desired band and it can be used for high-speed Multimedia communication.

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