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A RECONFIGURABLE CPW ANTENNA FOR GPS, GSM AND WLAN APPLICATIONS

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Introduction: Multiband reconfigurable antennas are receiving increasing importance in modern wireless communication systems supporting multiservice applications. The main advantage is the reduction in the size of wireless devices and allowing more space for other electronic components to be fitted. A widely tunable antenna using PIN switches was presented in [1]. Reconfigurable multiband antennas for wireless systems including satellite and terrestrial applications were reported in [2, 3]. This paper presents a new technique to electrically control the resonant frequencies by using a varactor diode. The antenna has an H-shape structure fed by a coplanar waveguide (CPW). It can generate and control up to three resonant frequencies to be used in GPS, GSM and Bluetooth/WLAN applications.

Design procedure and main results

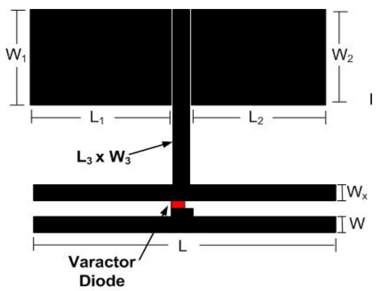
Reconfigurable antennas are based on changing their resonance properties by adding a PIN diode or a varactor diode. The advantage of using reconfigurable antenna is that the total antenna volume can be reused for other frequency bands and hence the overall size of the wireless device is reduced. Fig.1 shows the structure of the presented reconfigurable antenna. The detailed dimensions are listed in Table I. The antenna is designed with a total volume of 25 x 40 x 1.57 mm3 to make it suitable for compact wireless devices. The H-shape antenna consists of a 50 Ω CPW feed line and a varactor diode. The antenna is designed on a 1.57 mm FR-4 substrate with a dielectric constant of 4.4 and a loss tangent of 0.002. The widths of the H-shape are set to be 5 mm to allow the resonant frequencies to be controlled by the varactor diode.

Fig.1(a) shows the structure of the antenna and Fig.1 (b) shows the fabricated prototype on the FR-4 substrate along with the bias network. The simulated and measured return loss (S11 in dB) of the presented antenna for different varactor bias voltages are shown in Fig.2 (a)-(c). Fig. 2(a) shows the simulated and measured single band response generated from the antenna when the varactor diode is set to be 2 pF. At this setting, the antenna generates a single band centered at approximately 1.88 GHz serving GSM1900 (1850–1910 MHz) applications. By changing the capacitance of the varactor diode, the current path will be affected resulting in a change in the operating mode. If the capacitance of the diode is increased to 4 pF, another band is generated centered at 2.4 GHz serving WLAN and Bluetooth applications while the resonant frequency of GSM1900 band maintains its position as shown in Fig.2 (b). Similarly, if the capacitance is increased to 6 pF the third band is generated centered at 1.57 GHz for GPS (1575 MHz) applications with GSM1900 and WLAN bands maintaining their positions as shown in Fig. 2 (c). The DC bias line is used to apply the DC voltage to the varactor. The measured and simulated return loss results are in good agreement (Fig.2). The difference in measured and simulated the responses are mainly due to the accuracy of the fabrication process, which are within 3 % error as specified by manufacture. The measurements were taken using an Agilent N5230A network analyzer. The radiation patterns of the presented CPW antenna were measured at the SMART anechoic chamber of the National Physical Laboratory (NPL). The measured and simulated radiation patterns are in good agreement for co- and cross- polarized patterns in the three bands as shown in Fig. 3 (a)-(c).

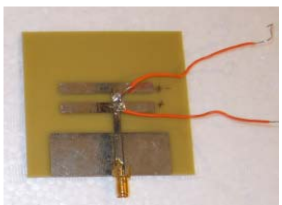
Further details and results will be presented in the full paper.

TABLE I
DETAILED DIMENSIONS OF THE PROPOSED ANTENNA (UNITS IN MM)

W	L	W_X	W_1	L_1
5	40	5	20	19.5
W_2	L_2	W_3	L_3	
20	26.5	3	11.6	

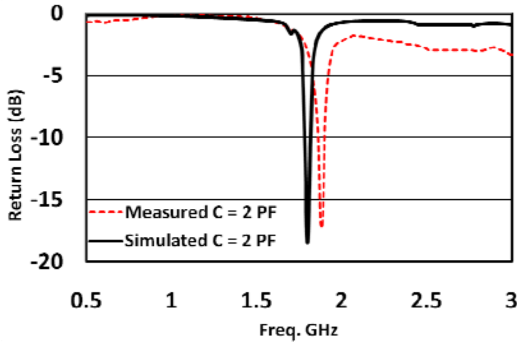


(a)

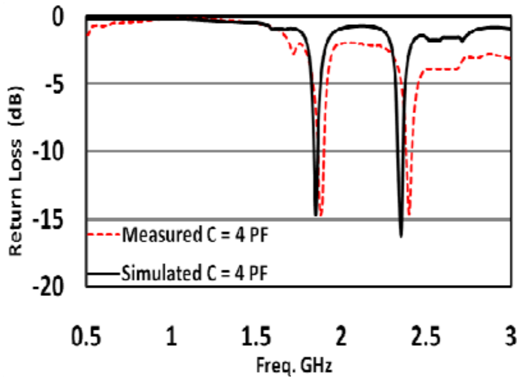


(b)

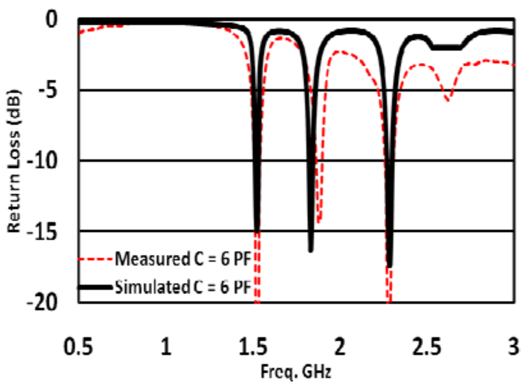
Fig. 1 (a) The layout of the presented antenna and the fabricated prototype (b)



(a)

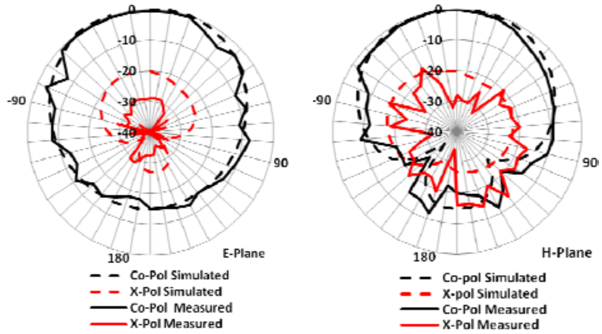


(b)

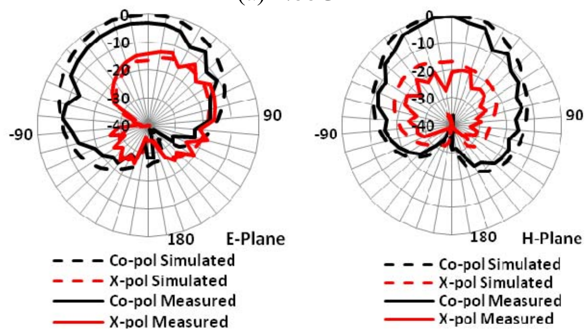


(c)

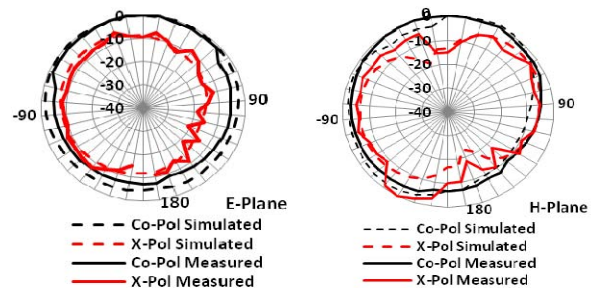
Fig. 2 Simulated and measured return loss for the three resonant frequencies at (a) 1.88GHz (b) 1.88GHz and 2.4GHz (c) 1.57GHz, 1.88GHz and 2.4GHz



(a) 1.88GHz



(b) 2.4 GHz



(c) 1.57GHz

Fig.3 Simulated and measured co- and cross polarised patterns for E and H plane radiation patterns at (a) 1.88GHz (b) 2.4 GHz (c) 1.57GHz

ACKNOWLEDGMENTS

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