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Flexible Antenna for Medical Application at WMTS Band

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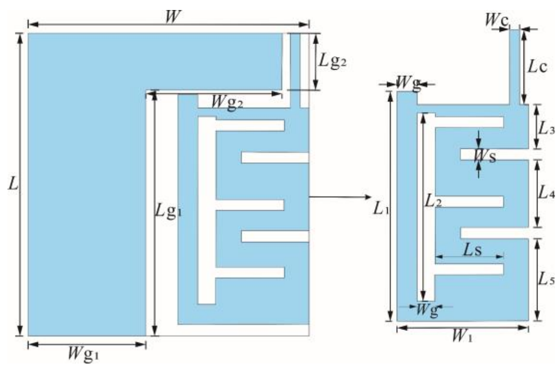
Abstract

A flexible antenna fed by coplaner waveguide(CPW) is designed. The simulation and experimental results verify the design for the medical application in the 1.4 GHz WMTS band [1]. A CPW is chosen over a coupling line for feeding because this simplifies the design by using only 1 layer of conductive material without an extra layer, which guaranteed low profile and compact size. We first investigated that the geometry of the proposed antenna. The overall structure consisted of L-shape ground plane and meander-type radiation patch and were etched a polyimide substrate (ε_r=3.6, tanδ=0.0652, thickness=0.05mm), and depicted in Fig. 1. Meanwhile, in order to make the antenna suitable for implantation, biocompatible superstrate silicon block was used to encapsulate the overall design [2]. The superstrate layer is mainly used to shield the antenna from direct contact of the living tissue. Also, the superstrate acts as a buffer between the metal radiator and human tissues by reducing RF power at the locations of loss human tissues. The proposed antenna has been designed and optimized using CST studio suite [3]. The final dimensions of the optimized antenna are the following: L=16, W=15, L_1=12.12, L_2=10, L_3=2.3, L_4=3.6, L_5=4.3, L_s=3.65, L_{g1}=13， W_{g1}=6.25, L_{g2}=3, W_{g2}=7.25, W_g=1, W_s=0.8, W_c=0.5, L_c=4 (unit: mm)。



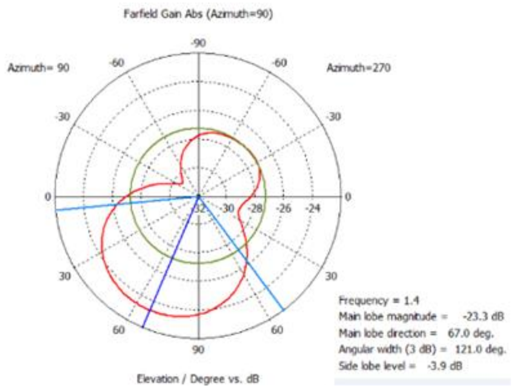
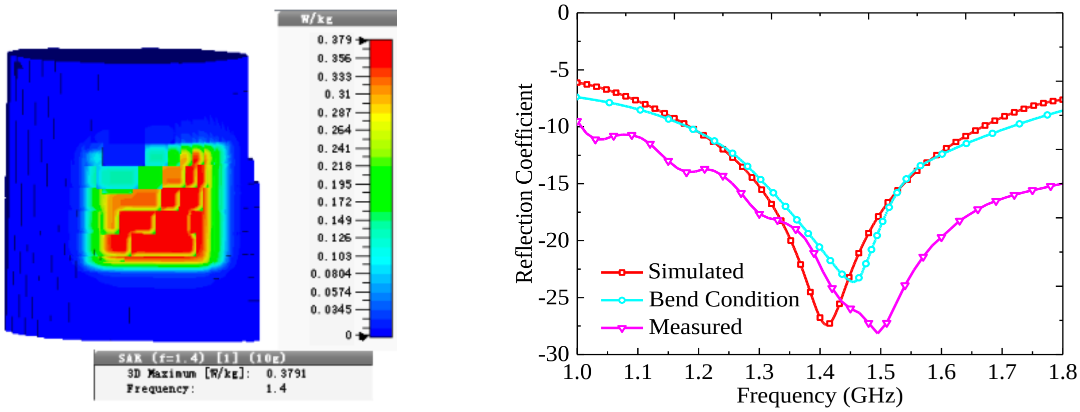


Figure 1: Geometry of the proposed antenna. Figure 2: Polar view of Far-Field Region.

We then studied the key performance of proposed antenna, such as radiation pattern, SAR value and reflection coefficient [4]. Radiation characteristics of the antenna can be manipulated from 2D view of the Far-Field radiation pattern. From Fig. 2, it can be observed that the main lobe magnitude is -23.3 dBi which is centered at 121 degrees with an angular width of 67 degrees. The maximum gain of the antenna is -28.898 dBi at θ = 75 degree and φ = 90 degree.



(a) (b)

Figure 3: (a) The Specific Absorption Rate (SAR) of 10-g averaged, (b) Reflection coefficients of the proposed antenna versus frequency.

From Fig. 3(a), we can see that the peak value of SAR is 2.15W/kg for an input power of 10 mW when the 10-g averaged, which is safe under safety regulations that the 10-g averaged SAR should not exceed 2W/kg as set by FCC and ICNIRP guidelines [5][6], and makes the antenna suitable for in body implantation.

Finally, the proposed antenna was fabricated to prove the simulated. Female SMA Connector was used as the port for the final fabricated design. Agilent technologies N5244A (10MHz–43.5GHz) Network analyzer was used to measure the antennas performance while embedded inside the minced pork. The reflection coefficient of proposed antenna are described in Fig.3(b) in different cases. The results of measured and bend condition are in good agreement with the simulation.

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