Curved Dual Band Film Antenna of Smart Watch for Cellular Communications

Yuki Tasaka and Hisao Iwasaki
Department of Electronic Information Systems, Shibaura Institute of Technology,
307 Fukasaku, Minuma-ku, Saitama, Japan

Abstract - **We present the small size curved dual band film antenna for the smart watch application. The proposed small size dual band film antenna by integrating on the smart watch belt can cover the cellular bands of 800 MHz band and 2GHz band. The simulated and measured results were agreed very well.**

Index Terms — **Curved film antenna, Dual band, Smart watch, Cellular communication.**

1. Introduction

Smart wearable devices, e.g. smart watches and smart wrist bands, are rapidly spreading nowadays and have attached attentions from people. Smart wearable devices need the access to wireless networks, and thus becomes a necessary component. However, due to the limited space within the wearable devices, most of smart wearable devices only have either a Bluetooth or a Wi-Fi antenna. Three different antennas for smart watch application, which can cover most of 2G/3G/4G cellular bands, were presented.[1] However, the size of these referenced antennas was large. To settle this problem, the small size curved dual band film antenna for 3G/4G cellular communications by using the smart watch belt was proposed.[2]

In this paper, the small size dual band film antenna for 3G/4G cellular communications by using the smart watch belt is proposed. And the comparison of the simulated and measured results is presented.

2. Proposed curved dual band antenna with an arm and simulated result

Antenna in smart watches mainly operate when they are worn by users, and thus it is important to simulate their performance with an arm. Fig.1 shows the proposed curved dual band antenna worn by an arm. The cloth with dielectric constant 1.2 and thickness T=3mm was inserted between the arm and the proposed curved antenna. To clear the dual band operational mechanism, the current distribution was simulated. From this result, the misrostrip stub was loaded at the electric current weak position and the size reduction was realized. The resonance frequency of 850 MHz was generated by the antenna element shown blue arrow. And the resonance frequency of 2 GHz band was generated by the antenna element shown yellow arrow. The parameters of the proposed curved antenna were adjusted as VSWR was less than 2 at both bands in the state by which the proposed curved antenna was wound around an arm. Fig.2 shows the simulated VSWR of the proposed curved dual band antenna worn by the arm as shown in Fig.1. In this simulation, the permittivity and conductivity of an arm were used the values as shown in Fig.1. VSWR less than 2 were obtained at both desired bands.

3. Comparison of simulated and measured result

To evaluate the simulated result of the proposed antenna, the film antenna is fabricated. Fig.3 shows the fabricated film antenna. The proposed antenna is fabricated on the film dielectric substrate (R-F775 with dielectric constant 2.17 and thickness 0.025 mm). The fabricated film antenna is fed by the coaxial cable with characteristic impedance 50 Ω. The proposed film antenna is measured in the state wound around an arm.

The cloth with dielectric constant 1.2 and thickness T=3mm is inserted between the arm and the fabricated film antenna. The parameters of the proposed curved film antenna was readjusted as VSWR was less than 2 at both bands in the state by which the proposed curved film antenna was wound around an arm.

Fig.4 shows the simulated and measured VSWR of the proposed curved dual band film antenna with an arm. Both 800 MHz band and 2 GHz band resonance frequencies of the fabricated film antenna were shifted higher frequency. At 800 MHz band, VSWR less than 2 was obtained. On the other hand, VSWR less than 2 was not realized at 2 GHz band. However, the desired bandwidth was obtained at both bands.

4. Conclusion

In this paper, we present the small size curved dual band film antenna for the smart watch application. The simulated sand measured results were agreed very well. So, the proposed small size dual band film antenna by integrating on the smart watch belt can cover the cellular bands of 800 MHz band and 2GHz band.

References

[1] Kun Zhao, Zinong Ying, Sailing He," Antenna Design of Smart Watch for Cellular Communications by using Metal Belt," Eucap2015, Bi3 wearable.5, April,2015.

[2] Yuki Tasaka, Hisao Iwasaki," Small Size Dual Band Monopole Antenna of Smart Watch for Cellular Communications," 2016 APWC, to be appeared.

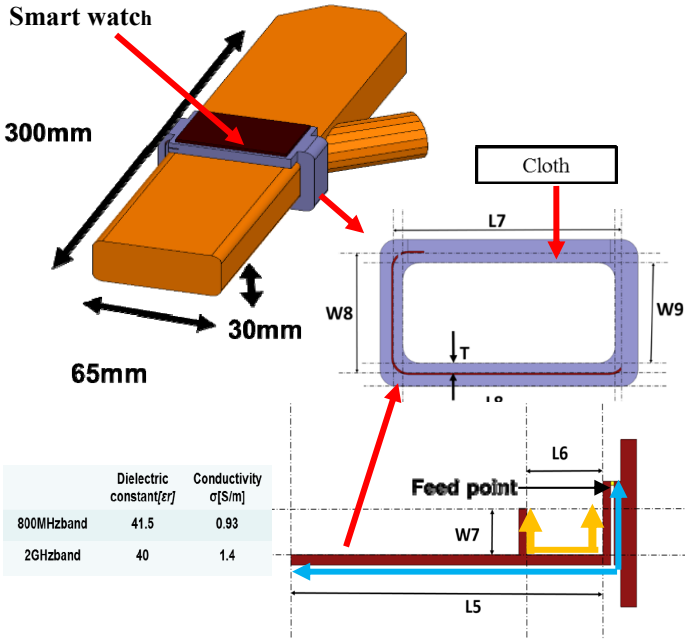
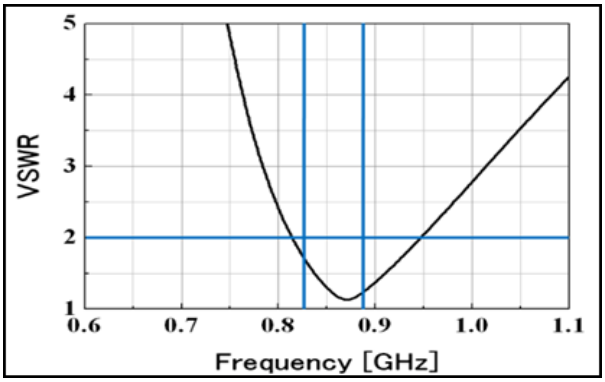
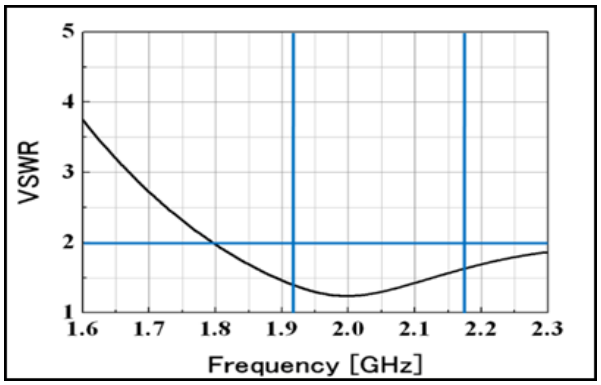


Fig.1. Proposed curved dual band antenna worn by an arm.



(a) 800 MHz band



(b) 2 GHz band

L5=81.5mm,L6=16mm,L7=71mm,L8=65mm,W7=8mm, W8=36mm, W9=30mm,T=3mm

Fig.2. Simulated VSWR of the proposed curved dual band antenna with an arm.

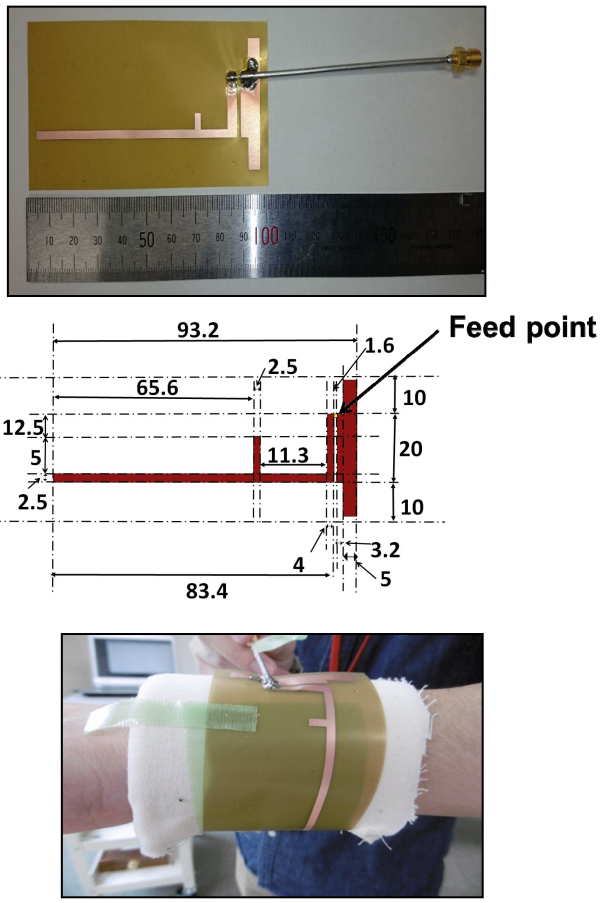
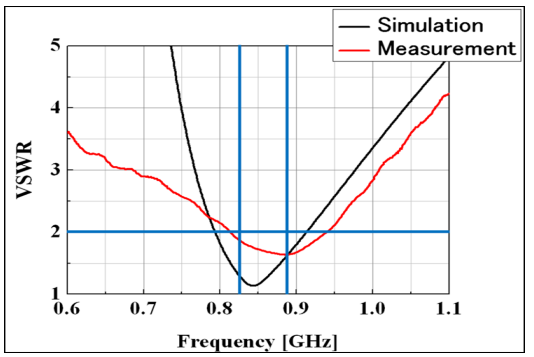
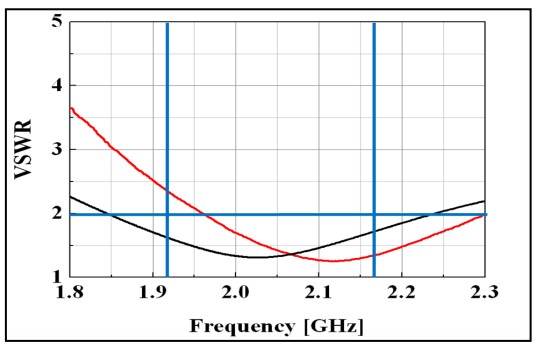


Fig.3. Fabricated proposed film antenna.



(a) 800 MHz band



(b) 2GHz band

Fig.4. Simulated and measured VSWR of the proposed curved dual band film antenna with an arm.