Basic Characteristics of Wideband Sleeve Antenna

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I. INTRODUCTION

Sleeve antenna is one typical antenna type that has a possibility of wideband characteristic. Until now, several types of sleeve antenna are introduced and investigated for obtaining a wider bandwidth than their original versions [1-5]. The most fundamental feature of sleeve antenna is that, a part of the exterior conductor with the length of $\lambda/4$ is removed from the coaxial cable, and only the thin interior conductor of this part is remained. With a sleeve added to the remained exterior surface of the coaxial cable. The operation bandwidth of a fundamental sleeve antenna is relatively narrow. In this study, we propose an effective impedance improvement technique for obtaining wideband characteristic of the fundamental sleeve antenna.

II. ANTENNA STRUCTURE

Figure 1 shows the configuration of our proposed antenna based on the fundamental structure of sleeve antenna. This model has an upper sleeve part added to the upper side of the fundamental sleeve antenna. For this reason, the sleeve part surrounding the radiation element is called upper sleeve and the sleeve added into coaxial cable side is called lower sleeve. Exterior conductor of the coaxial cable, upper sleeve and lower sleeve are electrically connected. Parameters of the antenna in details are shown in the Fig. 1. The total length of antenna is ***L***, the length of radiation element is ***le***, the length of upper sleeve is ***lu*** with a radius of ***du***, the length of lower sleeve is ***ll*** with a radius of ***dl***. On the other hand, parameters of ***le***, ***ll*** and ***dl*** are fixed to 30 mm, 27 mm and 10 mm, respectively. All the thickness of cylindrical conductor that is connected to the exterior conductor, upper sleeve and lower sleeve are set to 0.5 mm.

III. UPPER SLEEVE CHARACTERISTIC

In this section, we discuss about the wideband characteristic of the proposed antenna due to the tuning of the upper sleeve. In Fig 2, the total length of antenna is 100 mm, the radius of lower sleeve is fixed to 10 mm and the length of upper sleeve is fixed to 13 mm, while the radius of the upper sleeve is changed. As a result in Fig. 2, the VSWR of the proposed antenna around of 5.0 GHz is improved largely. It shows that the second multiplication of the resonant frequency improves when the radius become smaller and smaller. In Fig. 3, the radius of upper sleeve is fixed to 4 mm and the

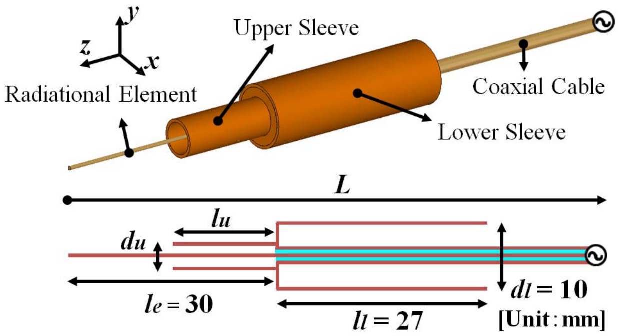

Figure 1: Antenna structure

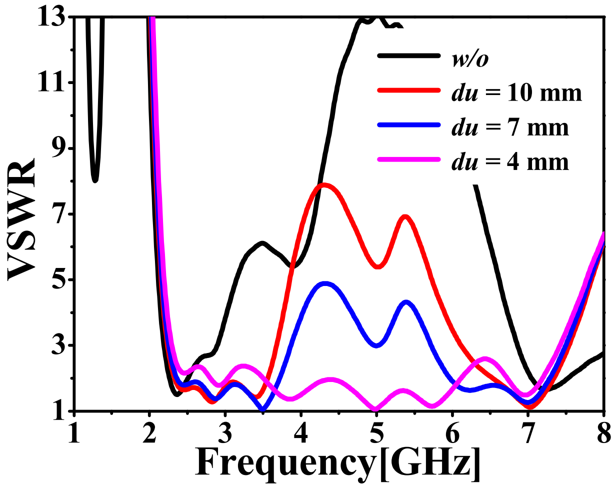

Figure 2: VSWR characteristic

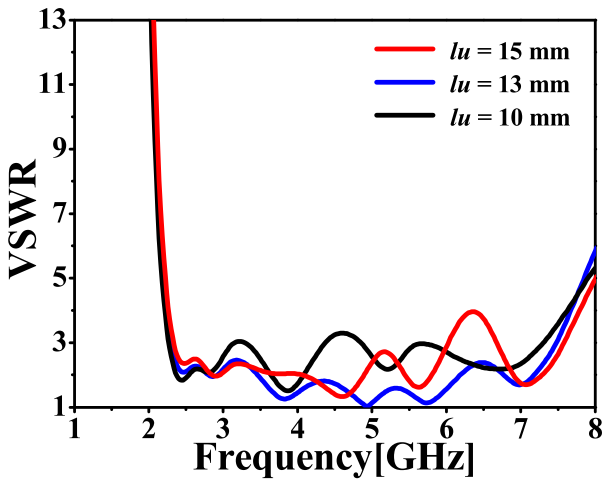

Figure 3: VSWR characteristic

length of upper sleeve is changed. A large variation of VSWR value at the second resonant frequency is changed according to the variation of ***lu***. We confirmed that the wideband characteristic of the proposed antenna can be achieved effectively if the optimum value of ***lu*** is chosen properly. The reason of this is that, when conventional sleeve antenna is added on upper sleeve, the current runs between radiation element and upper sleeve by cross coupling in the opposite direction. Therefore, the average current at bottom part of radiation element is increased. Besides when the radius becomes smaller and smaller, the impedance characteristic is improved by increase of average current.

IV. COAXIAL CABLE CHARACERISTIC

Figure 4 and 5 show the VSWR characteristic and the radiation patterns when ***L*** is changed when the ***lu*** = 13mm, ***du*** = 4mm. As the results in Fig. 3, there is no big deterioration on impedance characteristic. But the number of resonant frequency varies when ***L*** is changed. The resonant frequency of a proposed antenna includes unnecessary radiation by coaxial cable. And Fig. 4, the radiation patterns change very slightly at the fundamental mode of 2.5 GHz band. However, the variations of radiation patterns at 3.5 and

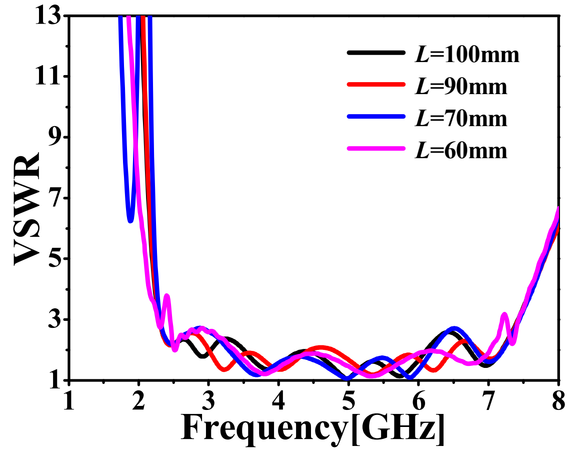

Figure 4: VSWR characteristic

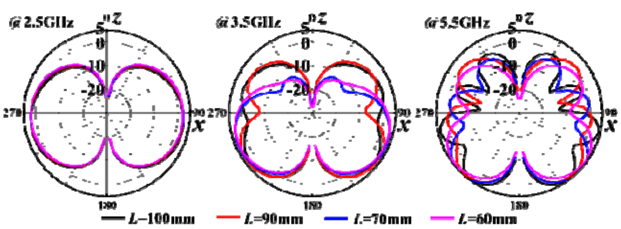

Figure 5: Radiation pattern

5.5 GHz band become larger, because the change of ***L*** affects to the radiation at high frequencies. However, if the total length of the coaxial cable part is decreased shorter and shorter, the deterioration of radiation pattern also decreases.

V. CONCLUSION

In this paper, we investigated the impedance improvement for obtaining the wideband characteristic of sleeve antenna. As a result, we confirmed that the i006Eput impedance of the proposed antenna can be improved much more if the length and radius of upper sleeve are adjusted properly surrounding the radiation element. Moreover, the proposed antenna has a good radiation characteristics at all covered frequency bands.

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