Circulator with Coplanar Waveguide Structure

Keiko Shitamitsu[1], Setsuo Yamamoto*[1], Hiroki Kurisu[1], Mitsuru Matsuura[1], Kazunori Oshiro[2] Hideto Mikami[3] and Shigeo Fujii[3]

[1] Yamaguchi University, 2-16-1 Tokiwadai, Ube, 755-8611, Japan
[2] Chugoku Technology Promotion Center, 4-33 Komachi, Naka-ku, Hiroshima, 730-0041, Japan
[3] Hitachi Metals, Ltd., 5200 Mikajiri, Kumagaya, 360-0843, Japan

*Corresponding author: e-mail: yamamoto@yamaguchi-u.ac.jp, Phone: +81 836 85 9621, Fax: +81 836 85 9621

In order to achieve the miniaturization and thickness reduction of mobile phones, decrease in thickness of circulators which is one of the key devices used in the mobile phones is strongly required. To meet this demand, we have proposed a new type low-height circulator with microstrip line structure [1]. In this study, the feasibility of a circulator using coplanar waveguide structures was investigated. The circulator with coplanar waveguide structure is expected to be easily fabricated at low cost because this circulator has a simple structure with a transmission line and a ground in the same plane.

The newly proposed circulator consists of a YIG ferrite substrate, a transmission line and a ground made of Ag and a dielectric plate. Transmission characteristics of the circulators were investigated using a high frequency electro-magnetic field simulation software "Ansoft HFSS" based on finite element method.

When a YIG ferrite substrate with $4\pi Ms$ of 900 G, a dielectric plate with relative dielectric constant of 40 was used in the circulator and magnetic bias field of 800 Oe was applied, relatively small insertion loss of 1.3 dB, large enough isolation of 23.4 dB, return loss of 24.2 dB and bandwidth of 60 MHz was obtained as shown in figure 1. The proposed circulator is one of the promising candidates for the future circulator.

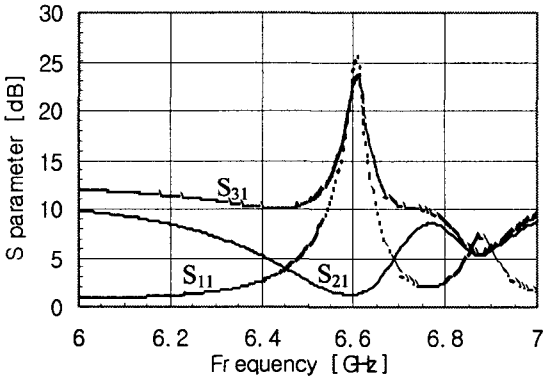

Fig.1. Transmission characteristics of circulator using coplanar waveguide.

References

[1] K. Oshiro, S. Yamamoto, H. Kurisu and M. Matsuura," Low height circulator using microstrip line," ISAM2, Symposium B-9, The 8th IUMRS International Conference on Advanced Materials (IUMRS-ICAM 2003), B9-10-O08, Yokohama, Japan, (2003).