Reflection characteristic evaluation of millimeter wave EM absorber without metal backing

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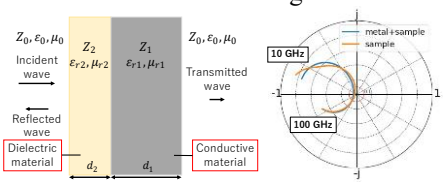
1. Introduction

Recently, various information and communication technologies have been developed. On the other hand, undesired electromagnetic (EM) waves generated by electronic devices can cause malfunctions of other devices. To eliminate above EM noises, EMC technologies such as EM wave absorbers and EM shielding materials are required.

In this study, the authors designed millimeter wave EM absorber without metal backing, and evaluated reflection characteristics of this EM wave absorber.

2. Configuration of Proposed EM Wave Absorber

Fig.1(a) shows the structure of the EM wave absorber proposed in this study. It is a two-layer EM wave absorber consist of conductive material which absorbs EM wave on the first layer and a dielectric material which reduces reflection from conductive layer on the second layer [1]. Fig. 1(b) shows the calculated results of the reflection coefficient by transmission line theory (Conductive material (EPDM/Carbon Black mixture):Thickness $d_1 = 1.2\text{mm}$, Conductivity $\sigma = 35\ \text{S/m}$, Relative permittivity $\varepsilon_{r2} = -j\sigma/\omega\varepsilon_0$, Relative permeability $\mu_{r1} = 1$, Dielectric material(FR4): Thickness $d_2 = 0.47\ \text{mm}$, Relative permittivity $\varepsilon_{r2} = 4.7$, Relative permeability $\mu_{r2} = 1$). From Fig.1(b), it can be confirmed that reflection characteristics are almost the same in both with and without metal backing. This structure makes it possible to design EM wave absorber without metal backing.

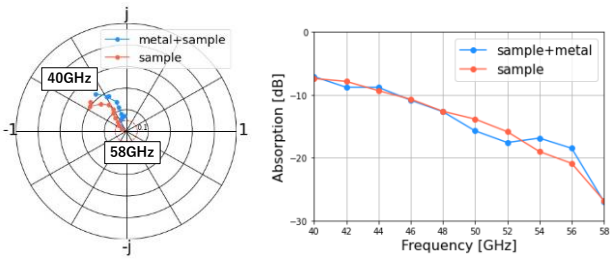


(a) Configuration of EM wave absorber (b) Reflection characteristics

Fig. 1 Proposed EM wave absorber

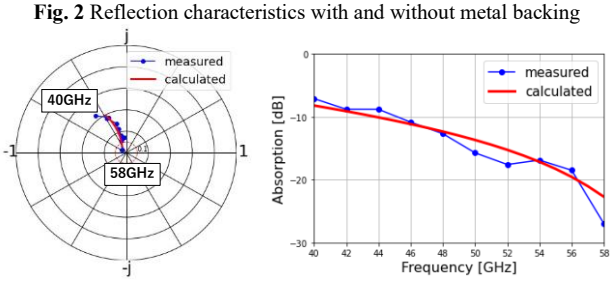
3. Measurement Result

Fig.2 shows the measured reflection coefficient by measurement setup for millimeter wave band [2]. The frequency range was set to 40 GHz ~ 58 GHz and the parameters are the same as those described in Chapter 2. From Fig.2, it can be confirmed that reflection characteristics are almost the same result with and without metal backing. In addition, Fig.3 shows the results of calculated and measured values with metal backing. From Fig.3, it can be confirmed that the measured values agree well to the calculated values.



(a) Reflection coefficient (b) Reflection characteristics

Fig. 2 Reflection characteristics with and without metal backing



(a) Reflection coefficient (b) Reflection characteristics

Fig. 3 Results of calculated and measured values with metal backing

4. Conclusion

In this study, we designed novel millimeter wave EM absorber without metal backing. From the measurement results, we confirmed that reflection characteristics are almost the same result with and without metal backing.

References

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[2]K. Hasegawa, et al., IEICE Technical Report, EMCJ2011-119, pp.47-52, 2012.

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