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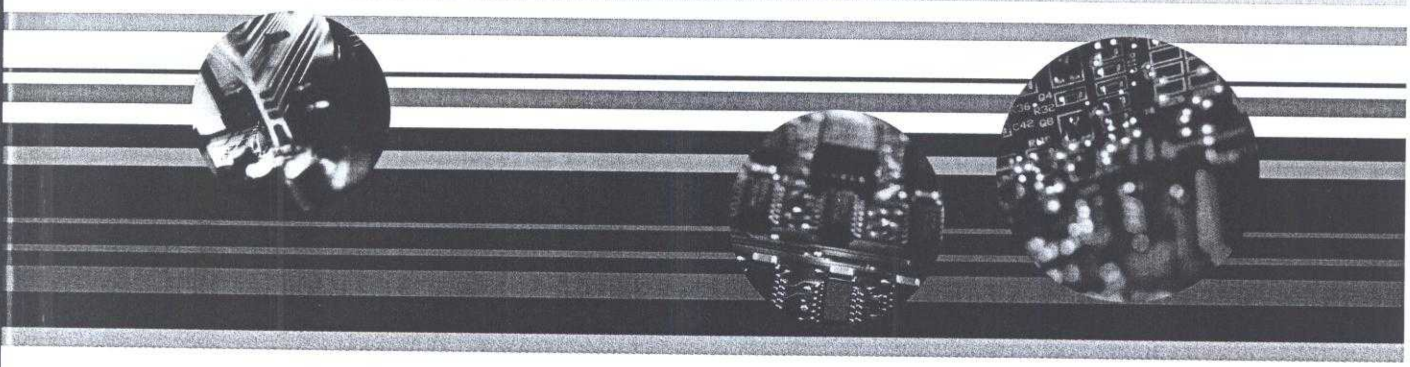

주최 : 사단법인 한국통신학회 마이크로파 및 전파 연구회
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협찬 : 로테슈바르즈, 맨엔텔, 메카텍, 모아소프트, 새한테크놀로지(주), 아이엔텍, 에더트로닉스, AWR, HCT, 한국텍트로닉스, 파트론, 한국해양대 농협

KICS KIEES

Special Session I — Antennas and Propagation

▶Place : Jasmine Hall (8th Fl.)

13:40~18:00 — **Chair : Jiro Hirokawa and Kangwook Kim**

[SP-1-1]	13:40~14:00	Matching-circuit-integrated millimeter-wave microstrip comb-line antennas for various number of elements	Kunio Sakakibara, N. Kikuma, and H. Hirayama (Nagoya Institute of Technology)
[SP-1-2]	14:00~14:20	Hybrid antenna for the 4G mobile phone	Taeho Son and Y. Jo (SoonChunHyang University, Skycross Korea)
[SP-1-3]	14:20~14:40	A remark on wireless transmission by a pair of small dipoles	Hiroyuki Arai (Yokohama National University)
[SP-1-4]	14:40~15:00	Investigation of fundamental aspect of wireless power transfer by spherical mode analysis	Y. G. Kim, Y. Tak, J. Park, and Sangwook Nam (Seoul National University)
[SP-1-5]	15:00~15:20	Polarization dependency of antenna mutual coupling reduction by using mushroom type EBG structures	Toshikazu Hori (Univerity of Fukui)
[SP-1-6]	15:20~15:40	Comparison of reconfigurable antenna performances by using RF switches	I. Yeom and Chang Won Jung (Seoul National University of Technology)
	15:40~16:00	Coffee Break	
[SP-1-7]	16:00~16:20	Double-layer waveguide slot array antennas by diffusion bonding of laminated thin metal plates	Jiro Hirokawa (Tokyo Institute of Technology)
[SP-1-8]	16:20~16:40	Novel hybrid antenna system with mechanical beam steering scheme	Young-Bae Jung, S. Eom, S. Jeon, J. Choi, and C. Kim (ETRI)
[SP-1-9]	16:40~17:00	Fundamental study on 2x2 MIMO performance comparison between V/H and +/-45degree dual polarized base station antenna	Keizo Cho and Y. Inoue (NTT DOCOMO)
[SP-1-10]	17:00~17:20	Investigation of antenna gain enhancement using an effective medium and Fabry-Perot cavity resonance	Dongho Kim and J. Choi (ETRI)
[SP-1-11]	17:20~17:40	An efficient FDTD technique for object which in contact with flat earth and its improving accuracy method	Takuji Arima and T. Uno (Tokyo University of Agriculture and Technology)
[SP-1-12]	17:40~18:00	Development trend for a vehicle radar system	Byung-Kwon Park and J. Kim (Hyundai Mobis)

Investigation of Fundamental Aspect of Wireless Power Transfer by Spherical Mode Analysis

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Ⅰ. Introduction

Wireless power transfer is a research area of interest recently. There are several ways for the analysis of the wireless power transfer characteristics. A method using spherical mode of antenna was proposed and it gives a clear view of the characteristics of near field coupling between two antennas[1]. This paper investigates the fundamental aspects of wireless power transfer using the spherical mode.

Ⅱ. Efficient Power Transfer Method

We assume that an antenna is the canonical minimum scattering(CMS) antenna and generates only a fundamental mode. Because antennas used for wireless power transfer are very small compared with wavelength, the assumption is valid. Z-parameter, optimum load impedance and maximum power transfer efficiency when two identical CMS antennas are coupled were given in [1]. When we analyze the equation in [1], we can find that the higher the radiation efficiency of an antenna is, the higher the power transfer efficiency is. Figure 1 shows the maximum power transfer efficiency of a near-field power transfer system when two identical antennas with radiation efficiency, η_{eff},

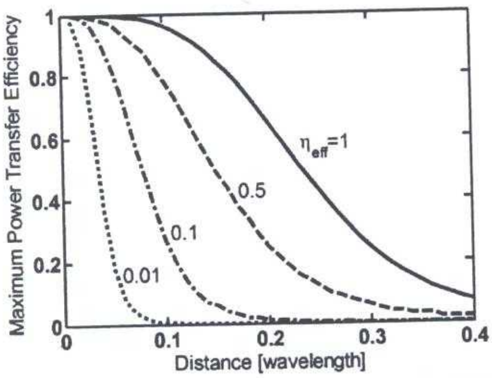

Figure 1. The maximum power transfer efficiencies of antennas with different radiation efficiencies

The graph in figure 1 is obtained by simultaneous matching at every distance. In practice, however, it is difficult to realize an adaptive simultaneous matching. So, the frequency tracking method is proposed by [2]. Figure 2 shows the power transfer efficiency of two different power transfer methods. The radiation efficiency of the antenna is 0.084 and the resonance frequency is 10.02MHz. The graph of the frequency tracking method is obtained by adjusting the frequency with the port impedance fixed on 50Ω. The frequency tracking method is easy to realize and can transfer the power efficiently in the strongly coupled region.

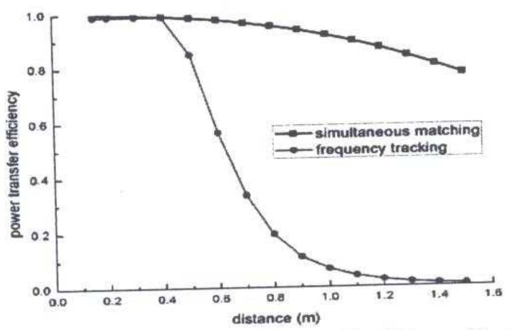

Figure 2. Comparison of the power transfer efficiency of two methods.

Ⅲ. Conclusion

This paper investigates the characteristics of a wireless power transfer using spherical mode. It shows that the high radiation efficiency antenna is a single design parameter for the efficient wireless power transfer. Also, it was found the frequency tracking method is an easy and efficient technique for the realization of efficient power transfer system in the situation that the distance between transmit and receiving antennas is varied.

Acknowledgment

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References

[1] J. Lee and S. Nam, "Fundamental aspects of near-field coupling small antennas for wireless power transfer," *IEEE Trans. Antennas and Propag.*, accepted for publication.

[2] J. Park, Y. Tak, Y. Kim, and S. Nam, "Investigation of adaptive matching methods for near-field wireless power transfer," *IEEE Trans. Antennas and Propag.*, submitted.