Letters

Comments on "High-Impedance Electromagnetic Surfaces with a Forbidden Frequency Band"

A. Kumar

In the above paper[1] the authors used a human's head as a jar of water and then made a statement that the dielectric constant of water is similar to most human tissues. We disagree with this statement [1]. The radiation pattern shown in Fig. 25(b) of the above paper presents a large discrepancy compared to our computed and measured radiation patterns for a human's head [2]. Therefore, application to the authors' theory in the above paper to the existing cellular phone antenna is not possible.

Fig. 25(c) in the above paper is cited within the paper's text, but is not shown, which is supposed to show the radiation pattern of a wire antenna on a high ground plane.

Manuscript received February 22, 2000.
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Publisher Item Identifier S 0018-9480(00)00029-6

[1] D. Sievenpiper, L. Zhang, R. F. J. Bross, N. G. Alexópolous and E. Yablonovitch, *IEEE Trans. Microwave Theory Tech.*, vol. 47, no. 11, pp. 2059–2074, Nov. 1999.

References

[1] C. Gabriel, "Compilation of the dielectric properties of body tissues at RF and microwave frequencies," Armstrong Lab., Brooks Air Force Base, TX, Res. Rep. AL/OE-TR-1996-0037, June 1996.
[2] A. Kumar, "Shielding the ill effects of EM radiation," *Microwaves RF*, vol. 35, no. 13, pp. 157–161, Dec. 1996.

Authors' Reply

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We respectfully disagree with the comments regarding the above paper.[1] It is claimed that our experimental results are invalid because water is a poor substitute for human tissue. While a jug of water and a human head may differ significantly in function, they differ little in form from the perspective of an electromagnetic field, and the substitution of one for the other offers simple insight into antenna performance near a high-dielectric lossy mass. We concede that the dielectric constant of water is roughly 1.5 times that of average human tissue. However, this neither invalidates our observation that antenna performance is significantly affected by the presence of a watery mass, nor our statement that one may expect similar degradation of performance near a human head. In fact, our measurements are in qualitative agreement with simulations involving realistic human tissue models [1], which indicate that radiated power may be roughly one-half in a typical cellular phone configuration.

The point of the above paper is not that water provides a perfect model for human tissue. The concept that we tried to convey to the readers is: antennas that we normally consider omnidirectional, such as a simple dipole, are not omnidirectional when placed near a large lossy high-dielectric medium. Furthermore, the performance of these antennas can be improved significantly while maintaining a low profile by shielding them with a textured ground plane as described in our paper. The fact that we demonstrated this using a simple example of a jug of tap water does not lessen the significance of the result.

Manuscript received August 4, 2000.
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Publisher Item Identifier S 0018-9480(01)00030-8.

[1] D. Sievenpiper, L. Zhang, R. F. J. Bross, N. G. Alexópolous and E. Yablonovitch, *IEEE Trans. Microwave Theory Tech.*, vol. 47, no. 11, pp. 2059–2074, Nov. 1999.

References

[1] M. Jensen and Y. Rahmat-Samii, "EM interaction of handset antennas and a human in personal communications," *Proc. IEEE*, vol. 83, July 1995.

Corrections to "Effects of Carrier Tracking in RAKE Reception of Wide-Band DSSS in Ricean Fading"

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Prompted by the questions of a reader, the authors would like to make the following clarifications and corrections to the above paper.[1]

1) Equation (1) in the above paper is only valid for small values of phase error, meaning for high values of loop SNR. In reality, there is a quadrature term present, one component of which is the sine of the phase error, and this latter term is negligible for small phase errors.

Manuscript received August 18, 2000.
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Publisher Item Identifier S 0018-9480(01)00028-X.

[1] R. E. Ziemer, B. R. Vojcic, L. B. Milstein, and J. G. Proakis, *IEEE Trans. Microwave Theory Tech.*, vol. 47, no. 6, pp. 681–686, June 1999.

2) We have assumed, consistent with the above assumption, that the loop bandwidth is very small, and that, therefore, the loop does not track the instantaneous amplitude variations. We then, for simplicity, assumed that the average SNR determined the loop statistics.
3) With regard to (4) in the above paper, [5] in the above paper had a constant c multiplying the real part operator. A derivation of (4) shows that this constant should not be there, thus, (4) is correct as it stands (to the best of our knowledge).
4) The definition of τ_k in the above paper [right below (4)] should have a factor of π present in the argument, as in [5]. This factor of π was, in fact, included in the computer code used to plot Figs. 1–10 in the above paper.
5) The actual mechanization of the computer code included (inadvertently) a factor of $1 + K$ in the denominator of the expression for the loop SNR [given right below (3) in the above paper]. Therefore, the loop SNRs specified in the captions of the figures in the above paper should be lower by $10 \log_{10}(1 + K)$ dB.