Corrections to "How Friendly Are Building Materials as Reflectors to Indoor LOS MIMO Communications?"

Yixin Zhang, Chen Chen, Songjiang Yang, Jiliang Zhang, Xiaoli Chu, and Jie Zhang

The authors regret the errors in [1, eqs. (13), (27), (34), and (35)]. The corrections for these equations are given as follows:

$$S = \frac{\|\mathbf{H}_1\|^2}{\left\|A_1 \mathbf{h}_{\beta_1}^{\mathrm{H}} \mathbf{h}_{\alpha_1}\right\|^2} = \frac{d_1^2}{d_2^2}|\Gamma|^2 + \frac{2Md_1}{N_{\mathrm{T}}N_{\mathrm{R}}d_2} + 1 \tag{13}$$

in which

$$M = \mathrm{Re}\left(\Gamma e^{-j2\pi \frac{d_2-d_1}{\mu}}\right) \frac{\sin\left(\frac{N_{\mathrm{T}}}{2}(\alpha_2-\alpha_1)\right)}{\sin\left(\frac{1}{2}(\alpha_2-\alpha_1)\right)} \frac{\sin\left(\frac{N_{\mathrm{R}}}{2}(\beta_2-\beta_1)\right)}{\sin\left(\frac{1}{2}(\beta_2-\beta_1)\right)}$$

and $\mathrm{Re}(\cdot)$ denotes the real part of a complex value

$$S' = \frac{\left\|\mathbf{H}_1'\right\|^2}{\left\|\nu_{\mathrm{m}} A_1 \mathbf{h}_{\beta_1}^{\mathrm{H}} \mathbf{h}_{\alpha_1}\right\|^2} = \frac{d_1^2 \nu_{\mathrm{b}}^2}{d_2^2 \nu_{\mathrm{m}}^2}|\Gamma|^2 + \frac{2Md_1\nu_{\mathrm{b}}}{N_{\mathrm{T}}N_{\mathrm{R}}d_2\nu_{\mathrm{m}}} + 1 \tag{34}$$

where M is given in the equations following (13)

$$\rho = \frac{\left(\bar{K}+1\right)\|\mathbf{H}_1\|^2 \rho_{\mathrm{T}}}{\bar{K} N_{\mathrm{R}} N_{\mathrm{T}}} \tag{27}$$

$$\rho' = \frac{\left(K'+1\right)\left\|\mathbf{H}_1'\right\|^2 \rho_{\mathrm{T}}}{K' N_{\mathrm{R}} N_{\mathrm{T}}}. \tag{35}$$

Accordingly, [1, Figs. 9–11 and 15–17] and their descriptions should be updated as follows.

In the second paragraph of Section VI-C: "Figs. 9 and 10 plot the spatially averaged capacity as a function of the permittivity and the thickness of building materials, respectively. In Fig. 9, as the permittivity increases from 1 to 10, the envelope of the spatially averaged capacity presents an upward trend. The variation in the spatially averaged capacity becomes more significant with the increase of the permittivity. In Fig. 10, for a given permittivity, as the wall thickness increases, the spatially averaged capacity first fluctuates with it under a decreasing envelope and gradually converges to a constant value when the thickness goes beyond 0.25 m. We observe quite severe

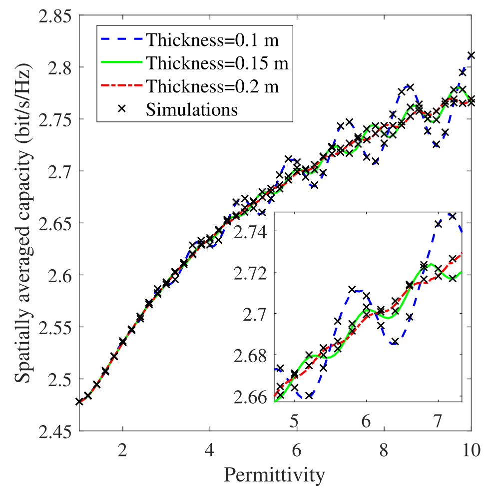

Fig. 9. Impact of wall permittivity on spatially averaged capacity for the omnidirectional BS antenna array for $\rho_{\mathrm{T}} = 60$ dB.

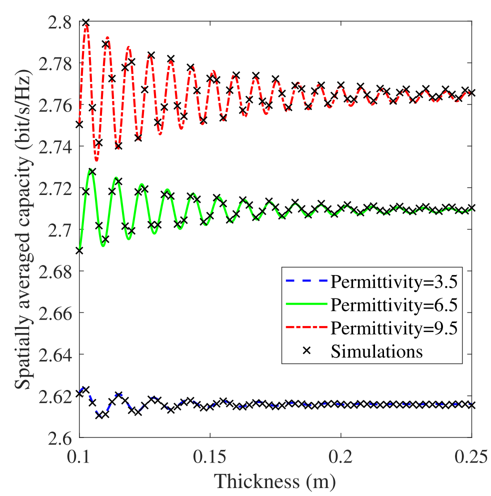

Fig. 10. Impact of wall thickness on spatially averaged capacity for the omnidirectional BS antenna array for $\rho_{\mathrm{T}} = 60$ dB.

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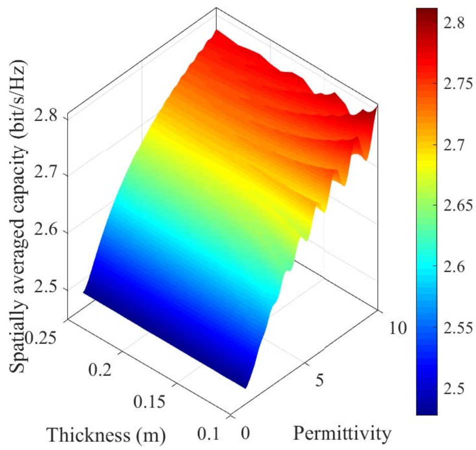

Fig. 11. Composite impact of permittivity and thickness on spatially averaged capacity for the omnidirectional BS antenna array for $\rho_T = 60$ dB.

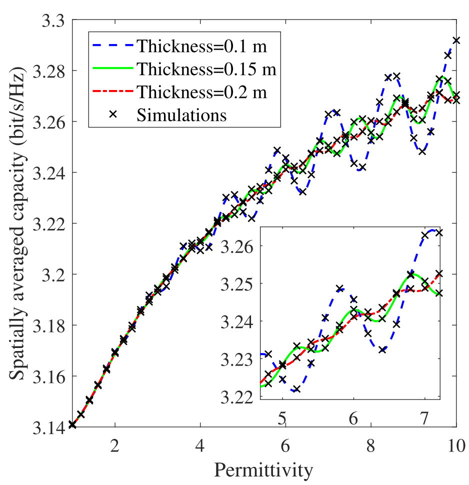

Fig. 15. Impact of wall permittivity on spatially averaged capacity for the directional BS antenna array for $\rho_T = 60$ dB.

fluctuations of the spatially averaged capacity at relatively small wall-thickness values. That is because the reflection coefficient amplitude fluctuates more severely when the wall is thinner. According to Figs. 9 and 10, we note that a tiny lapse in the wall permittivity or thickness will change the spatially averaged capacity by up to 0.333 bit/s/Hz."

In the last paragraph of Section VI-C: "The composite impact of the building material's permittivity and thickness on the spatially averaged capacity is illustrated in Fig. 11. When the permittivity and the thickness are configured in the range from 1 to 10 and from 0.1 to 0.25 m, respectively, we observe that the optimal pair of $[\varepsilon_0, \zeta]$ resulting in the highest spatially averaged capacity of 2.812 bit/s/Hz is [10, 0.1], while the worst pair resulting in the lowest spatially averaged capacity of 2.478 bit/s/Hz is [1, 0.1]. We can conclude that certain combinations of the wall thickness and permittivity values lead to peak values of the spatially averaged capacity, which can be more than 13.5% higher than the lowest spatially averaged capacity values. The combinations of the wall thickness and permittivity values associated with the latter should be avoided during the selection and/or design of building materials."

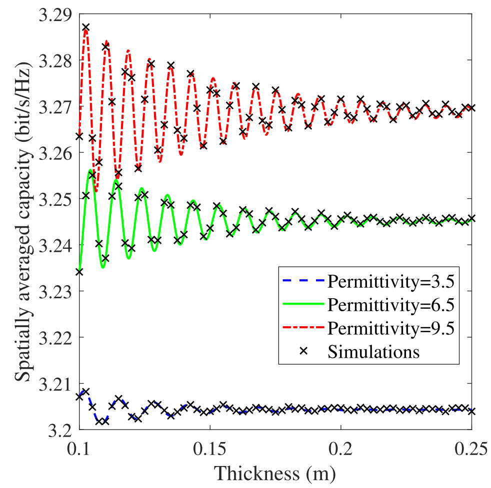

Fig. 16. Impact of wall thickness on spatially averaged capacity for the directional BS antenna array for $\rho_T = 60$ dB.

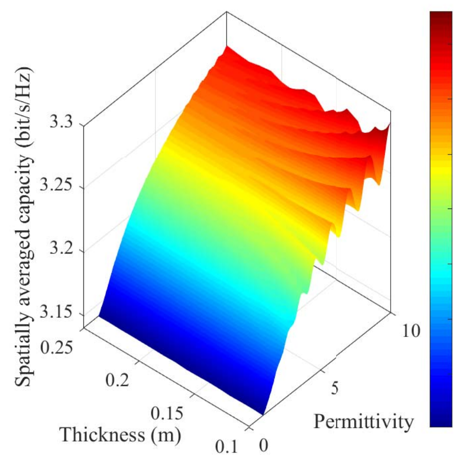

Fig. 17. Composite impact of permittivity and thickness on spatially averaged capacity for the directional BS antenna array for $\rho_T = 60$ dB.

In the fourth paragraph of Section VI-D: "With regards to the impact of the wall permittivity and thickness on the spatially averaged capacity, significant variations up to 0.151 bit/s/Hz can be observed in Figs. 15 and 16. In Fig. 17, it is found that the optimal pair of $[\varepsilon_0, \zeta]$ leading to the highest spatially averaged capacity of 3.292 bit/s/Hz is [10, 0.1], while the worst pair leading to the lowest spatially averaged capacity of 3.141 bit/s/Hz is [1, 0.1]. The potential 4.8% difference in the spatially averaged capacity generated by different combinations of the wall permittivity and thickness is worthy of careful consideration in the selection and/or design of building materials."

Note that the updated equations (13), (27), (34), and (35) will not affect any other equations or figures in [1].

Reference

[1] Y. Zhang, C. Chen, S. Yang, J. Zhang, X. Chu, and J. Zhang, "How friendly are building materials as reflectors to indoor LOS MIMO communications?" *IEEE Internet Things J.*, vol. 7, no. 9, pp. 9116–9127, Sep. 2020.