Computational electromagnetics (CEM) methods are used to analyze indoor wireless propagation in a simple dielectric enclosure. The statistical distribution of the fields (fast fading) is predicted and compared with Rayleigh and Rician models. It is found that the field distribution tends toward Rician for low dielectric walls, and toward Rayleigh for high dielectric walls, because the latter case causes more multipath interference in the enclosure. It is also shown that the numerical sampling density of the CEM solution may be relaxed from the typical 8 points/wavelength down to 2 or 3 points/wavelength when predicting room-averaged statistics, but not location-specific signal fading.