

## Answer on question #61778, Physics, Electromagnetism

Different materials transmit or reflect Wi-Fi signals to differing degrees. What is happening within the materials at an atomic level, to cause the different behavior? Why do materials with high dielectric constant tend to reflect Wi-Fi signals, while low dielectric materials allow Wi-Fi to pass through?

### Answer:

When the wave propagates in the material environment the change of its phase velocity and absorption of energy occurs. This can be explained by the excitation of oscillations of the electrons and ions in atoms and molecules of the environment under the influence of an electric field of the wave and re-emission of secondary waves. If the intensity of the wave is smaller than the field strength that acting on an electron in an atom, the electron oscillations under the influence of the wave field occur harmonically with the same frequency of the waves. Therefore, the electrons emit radio waves of the same frequency but with different amplitudes and phases. The phase shift between the primary and re-radiation waves leads to the change in the phase velocity. Energy losses in the interaction of the waves with the atoms is the reason of the absorption of radio waves. Absorption and changing phase velocity in the environment characterized by the index of the absorption  $\chi$  and the refractive index  $n$ , that depends on the permittivity  $\epsilon$  and the conductivity  $\sigma$  of the environment:

$$\chi = \sqrt{\frac{1}{2} \sqrt{\epsilon^2 + (60\lambda\sigma)^2} - \epsilon}$$
$$n = \sqrt{\frac{1}{2} \sqrt{\epsilon^2 + (60\lambda\sigma)^2} + \epsilon}$$