The perpendicular components of B (magnetic flux density) and D (electric displacement field) and the parallel components of E (electric field) and H (magnetic field) are continous through the interface of two dielectrics. A derivation for this relations can be found in the lecture notes of the Electrodynamics course (chapter 12).
This leads us the the continuity condition for our problem:

$$n \times E_R = n \times (E_I + E_T) \tag{1}$$

$$n \cdot \epsilon_2 E_R = n \cdot \epsilon_1 (E_I + E_T) \tag{2}$$

The components of the electromagnetic waves have the form $A_0 e^{i(kx-\omega t)}$. At the interface the phase of the incoming, the reflected and the transmitted wave is the same.

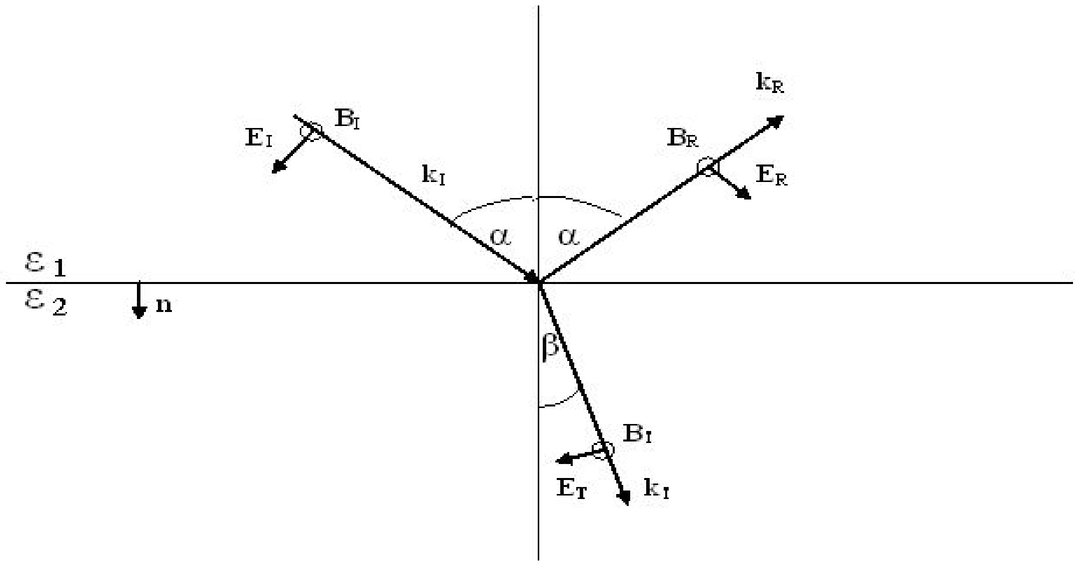

Abbildung 1: Refraction and Reflection of an EM Wave on an Interface.

From (2) we get

$$\epsilon_2 E_{0T}\cos(\frac{\pi}{2}-\beta)-\epsilon_1(E_{0I}\cos(\frac{\pi}{2}-\alpha)+E_{0R}\cos(\frac{\pi}{2}-\alpha))=0$$

$$\Leftrightarrow$$

$$\epsilon_2 E_{0T}\sin\beta-\epsilon_1(E_{0I}+E_{0R})\sin\alpha=0$$

Snell's law of reflection says $n_1\sin\alpha=n_2\sin\beta$ and thus

$$\frac{\epsilon_2}{\epsilon_1}\frac{n_1}{n_2}E_{0T}\cancel{\sin\alpha}-(E_{0I}+E_{0R})\cancel{\sin\alpha}=0 \tag{3}$$

From (1) we get

$$E_{0T}\sin(\frac{\pi}{2}-\beta)=(E_{0I}-E_{0R})\sin(\frac{\pi}{2}-\alpha)$$

$$\Leftrightarrow$$

$$E_{0T}\cos\beta=(E_{0I}-E_{0R})\cos\alpha$$

$$\Leftrightarrow$$

$$E_{0T}\frac{\cos\beta}{\cos\alpha}-E_{0I}+E_{0R}=0 \tag{4}$$

We add eq.(3) and eq.(4) and get

$$E_{0T}(\frac{\cos\beta}{\cos\alpha}+\frac{\epsilon_2}{\epsilon_1}\frac{n_1}{n_2})=2E_{0I}$$

If we assume that the permeability is the same in both materials, we get

$$\frac{E_{0T}}{E_{0I}}=\frac{2}{\frac{\cos\beta}{\cos\alpha}+\frac{n_2}{n_1}}$$

$$\Leftrightarrow$$

$$\frac{E_{0T}}{E_{0I}}=\frac{2\cos\alpha}{\cos\beta+\frac{n_2}{n_1}\cos\alpha} \tag{5}$$

We go back to eq.3 and divide on both sides by E_{0I}. We also use $\frac{\epsilon_2}{\epsilon_1}\frac{n_1}{n_2}=\frac{n_2}{n_1}$

$$\frac{E_{0R}}{E_{0I}}=\frac{n_2}{n_1}\frac{E_{0T}}{E_{0I}}-1$$

Now we plug in eq.(5) and get

$$\frac{E_{0R}}{E_{0I}}=\frac{n_2}{n_1}\frac{2\cos\alpha}{\cos\beta+\frac{n_2}{n_1}\cos\alpha}-1$$

$$\Leftrightarrow$$

$$\frac{E_{0R}}{E_{0I}} = \frac{n_2 \cos\alpha - n_1 \cos\beta}{n_2 \cos\alpha + n_1 \cos\beta} \tag{6}$$

We get our result - the complex reflectance coefficient - when we plug in the complex index of refraction $n_1 = \widetilde{n_1} + iK_1$ and $n_2 = \widetilde{n_2} + iK_2$

$$\frac{E_{0R}}{E_{0I}} = \frac{(\widetilde{n_2} + iK_2)\cos\alpha - (\widetilde{n_1} + iK_1)\cos\beta}{(\widetilde{n_2} + iK_2)\cos\alpha + (\widetilde{n_1} + iK_1)\cos\beta} \tag{7}$$

We can compare this result with the given solution in Kittel for light perpendicular to the surface. In this case $\alpha = \beta = 0$. Moreover $n_1 = 1$ (vacuum). Plugging that into eq.(7) leads us to the same result as in Kittel,

$$\frac{E_{0R}}{E_{0I}} = \frac{(\widetilde{n_2} + iK_2) - 1}{(\widetilde{n_2} + iK_2) + 1}$$