```
a = k1/ω (α1 - β1) - k2/ω α2 == 0
b = α1 + β1 == α2
```

$$-\frac{k2\,\alpha2}{\omega}+\frac{k1\,(\alpha1-\beta1)}{\omega}==0$$

$$\alpha1+\beta1==\alpha2$$

```
Solve[a && b, {α2, β1}] // FullSimplify
```

$$\left\{\left\{\alpha2\to\frac{2\,k1\,\alpha1}{k1+k2},\ \beta1\to\frac{(k1-k2)\,\alpha1}{k1+k2}\right\}\right\}$$

```
R = (1 - Sqrt[ϵ / ϵ0 + I σ / ϵ0 ω]) / (1 + Sqrt[ϵ / ϵ0 + I σ / ϵ0 ω])
```

$$\frac{1-\sqrt{\frac{\epsilon}{\epsilon_0}+\frac{i\,\sigma\,\omega}{\epsilon_0}}}{1+\sqrt{\frac{\epsilon}{\epsilon_0}+\frac{i\,\sigma\,\omega}{\epsilon_0}}}$$

```
A = ComplexExpand[Re[R]] // FullSimplify
```

$$-\frac{-1+\sqrt{\frac{\epsilon^2+\sigma^2\,\omega^2}{\epsilon_0^2}}}{1+2\,\text{Cos}\left[\frac{1}{2}\,\text{Arg}\left[\frac{\epsilon+i\,\sigma\,\omega}{\epsilon_0}\right]\right]\left(\frac{\epsilon^2+\sigma^2\,\omega^2}{\epsilon_0^2}\right)^{1/4}+\sqrt{\frac{\epsilon^2+\sigma^2\,\omega^2}{\epsilon_0^2}}}$$

```
B = ComplexExpand[Im[R]] // FullSimplify
```

$$-\frac{2\,\text{Sin}\left[\frac{1}{2}\,\text{Arg}\left[\frac{\epsilon+i\,\sigma\,\omega}{\epsilon_0}\right]\right]\left(\frac{\epsilon^2+\sigma^2\,\omega^2}{\epsilon_0^2}\right)^{1/4}}{1+2\,\text{Cos}\left[\frac{1}{2}\,\text{Arg}\left[\frac{\epsilon+i\,\sigma\,\omega}{\epsilon_0}\right]\right]\left(\frac{\epsilon^2+\sigma^2\,\omega^2}{\epsilon_0^2}\right)^{1/4}+\sqrt{\frac{\epsilon^2+\sigma^2\,\omega^2}{\epsilon_0^2}}}$$

```
Amplitude = Sqrt[A^2 + B^2] // Expand // FullSimplify
```

$$\sqrt{\frac{\epsilon^2+\sigma^2\,\omega^2+\left(1-2\,\text{Cos}\left[\text{Arg}\left[\frac{\epsilon+i\,\sigma\,\omega}{\epsilon_0}\right]\right]\sqrt{\frac{\epsilon^2+\sigma^2\,\omega^2}{\epsilon_0^2}}\right)\epsilon_0^2}{\left(1+2\,\text{Cos}\left[\frac{1}{2}\,\text{Arg}\left[\frac{\epsilon+i\,\sigma\,\omega}{\epsilon_0}\right]\right]\left(\frac{\epsilon^2+\sigma^2\,\omega^2}{\epsilon_0^2}\right)^{1/4}+\sqrt{\frac{\epsilon^2+\sigma^2\,\omega^2}{\epsilon_0^2}}\right)^2\epsilon_0^2}}$$

```
F = ComplexExpand[Abs[R]] // FullSimplify
```

$$\frac{\sqrt{1-2\,\text{Cos}\left[\frac{1}{2}\,\text{Arg}\left[\frac{\epsilon+i\,\sigma\,\omega}{\epsilon_0}\right]\right]\left(\frac{\epsilon^2+\sigma^2\,\omega^2}{\epsilon_0^2}\right)^{1/4}+\sqrt{\frac{\epsilon^2+\sigma^2\,\omega^2}{\epsilon_0^2}}}}{\sqrt{1+2\,\text{Cos}\left[\frac{1}{2}\,\text{Arg}\left[\frac{\epsilon+i\,\sigma\,\omega}{\epsilon_0}\right]\right]\left(\frac{\epsilon^2+\sigma^2\,\omega^2}{\epsilon_0^2}\right)^{1/4}+\sqrt{\frac{\epsilon^2+\sigma^2\,\omega^2}{\epsilon_0^2}}}}$$

```
B / A // FullSimplify
```

$$\frac{2 \sin\left[\frac{1}{2} \operatorname{Arg}\left[\frac{\epsilon + i\,\sigma\,\omega}{\epsilon_0}\right]\right] \left(\frac{\epsilon^2 + \sigma^2\,\omega^2}{\epsilon_0^2}\right)^{1/4}}{-1 + \sqrt{\frac{\epsilon^2 + \sigma^2\,\omega^2}{\epsilon_0^2}}}$$