Determine ε', ε'', and the effective conductivity σ of nylon (610) at 3 GHz at 25°C. [Hint: Appendices E, F, & G.]

From Appendix G, $\varepsilon_r = 2.84$ and $\tan\delta = 0.012$ at 3 GHz for nylon (610).

➤ Per notes, $\varepsilon' = \varepsilon_r\,\varepsilon_0 = 2.84\,(8.8541878\times10^{-12}\text{ F/m})$

$$\Rightarrow \underline{\boldsymbol{\varepsilon' = 2.5146 \times 10^{-11}\ \text{F/m}}}.$$

➤ Per notes, $\varepsilon'' = \varepsilon'\tan\delta = 2.5146\times10^{-11}\,(0.012)$

$$\Rightarrow \underline{\boldsymbol{\varepsilon'' = 3.0175 \times 10^{-13}\ \text{F/m}}}.$$

➤ Per notes, $\varepsilon'' = \sigma/\omega$. So, the effective conductivity is $\sigma = \omega\,\varepsilon''$.

$\sigma = 2\pi\,(3\times10^{9})\,3.0175\times10^{-13}$ $\Rightarrow \underline{\boldsymbol{\sigma = 0.0056879\ \text{S/m} = 5.6879\ \text{mS/m}}}.$