3.2 Design BT patch antenna

$\varepsilon_r = 2.2$, $f_r = 2.44\ GHz$, $h = 3\ mm$

Step 1: Determine W (width)

$$W = \frac{V_0}{2 f_r}\sqrt{\frac{2}{\varepsilon_r + 1}} = 4.86\ cm$$

Step 2: Determine L (length)

$$\varepsilon_{reff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left(1 + 12\frac{h}{W}\right)^{-1/2} = 2.055$$

$$\Delta L = h \cdot 0.412 \frac{(\varepsilon_{reff} + 0.3)\left(\frac{W}{h} + 0.264\right)}{(\varepsilon_{reff} - 0.258)\left(\frac{W}{h} + 0.8\right)} = 0.157\ cm$$

$$L = \frac{V_0}{2 f_r \sqrt{\varepsilon_{reff}}} - 2\cdot\Delta L = 3.975\ cm$$

← L: Mekanisk lengde

$$L_{eff} = L + 2\cdot\Delta L = 4.29\ cm$$

← L_{eff}: Elektrisk lengde

Step 3: Determine feed point

$R_{in0} = 240\ \Omega$, $R_{inL} = 50\ \Omega$

$$R_{inL} = R_{in0}\cdot\cos^2\left(\frac{\pi}{L} y_0\right) \Rightarrow y_0 = \frac{L}{\pi}\cdot\cos^{-1}\left(\sqrt{\frac{R_{inL}}{R_{in0}}}\right) = 1.39\ cm$$

Step 4: Determine width of microstrip

$\frac{W_0}{h} > 1$, so

$$Z_c = \frac{120\pi/\sqrt{\varepsilon_{reff}}}{\frac{W_0}{h} + 1.393 + 0.667\cdot\ln\left(\frac{W_0}{h} + 1.444\right)} = 50\ \Omega$$

Solve numerically to get $W_0 = 0.93\ cm$