Calculations of the antenna:

Theoretical:

All lenghts in metric

$$\mathrm{E}_r = 4.3$$

h=0.0001

$$\epsilon_0 = 8.85418 * 10^{-12}$$

$$\mu_0 = 1.256637 * 10^{-6}$$

$$Patch\ Width: W = \frac{1}{2f(\sqrt{\epsilon_0\mu_0})}\sqrt{\frac{2}{\epsilon_r + 1}}$$

$$W = 0.0438$$

$$Effective\ Dielectric\ constant: \epsilon_{reff} = \left(\frac{\epsilon_r + 1}{2}\right) + \left[\left(\frac{\epsilon_r - 1}{2}\right)\left(1 + 12\frac{h}{W}\right)^{-0.5}\right]$$

$$\epsilon_{reff} = 3.41805$$

$$\text{Patch length extension: } \Delta L = 0.412h\ \frac{(\epsilon_{reff} + 0.3)(\frac{W}{h} + 0.264)}{(\epsilon_{reff} - 0.258)(\frac{W}{h} + 0.8)}$$

$$\Delta L = 0.0004841$$

$$Patch\ Length: L = \left(\frac{1}{2f\sqrt{\epsilon_{reff}}\sqrt{\epsilon_0\mu_0}}\right) - 2\Delta L$$

$$L = 0.0386$$

$$Effective\ lenght: L_{eff} = L + 2\Delta L$$

$$L_{eff} = 0.0395682$$

LG = 2L+6h

$$LG = 2 * 0.0386 + 6 * 0.0001 = 0.0778$$

WG= $2W + 6h$

$$WG = 0.0438 * 2 + 6 * 0.0001 = 0.0882$$

$$SW = \frac{8h\ \exp(\frac{Z_0\sqrt{\epsilon_{eff}}}{60})}{\exp(\frac{Z_0\sqrt{\epsilon_{eff}}}{60}) - 2}$$

$$SW = \frac{8 * 0.0001 \exp(\frac{50\sqrt{3.41805}}{60})}{\exp(\frac{50\sqrt{3.41805}}{60}) - 2} = 0.000139977$$

$$SL = \frac{\lambda_d}{4}$$

$$\lambda_d = \frac{c}{f\sqrt{\epsilon_{eff}}}$$

$$\lambda_d = \frac{3 * 10^8}{2100 * 10^6 * \sqrt{3.41805}} = 0.00772703$$

$$SL = \frac{0.0072703}{4} = 0.001817575$$

Practical results – obtained by the method or trial and error method:

Ground Lenght(LG): 67.9mm

Ground Width(WG): 77.2mm

Substrate Height (h): 1mm

Patch Width (W): 42.8mm

Patch Lenght(L): 33.5mm

Strip Weight (SW) = 1.6mm

Strip Lenght: (SL)=17.2mm

Cut Strip Weight (VAC_W): 0.78 mm

Cut Strip Lenght (VAC_L) : 11.1mm

Material Height (Mt): 0.105mm

Reference:

Soh, Ping Jack & Rahim, MKA & Asrokin, Azhari & Abd Aziz, Mohamad Zoinol. (2007). Design, Modeling, and performance Comparison of feeding techniques for a Microstrip Patch Antenna. Jurnal Teknologi. 47D. 103-120. 10.11113/jt.v47.270.