

MicroEngine Antenna Tuning

The antennas used for the 13,56 MHz **MICROENGINE** are parallel resonant devices consisting of an antenna loop inductivity and a capacitor in parallel. This parallel circuitry has to be in resonance to operate.

If the inductivity of the antenna is known, a first estimate of the tuning capacitor can be determined using:

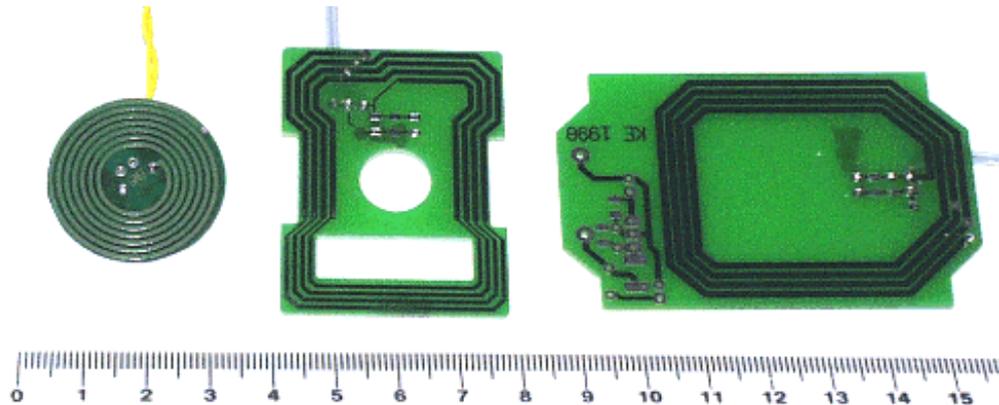
$$C[F] = \frac{1}{L[H] * (2 * 3.141592 * 13.56 * 10^6)^2} + 65 * 10^{-12} [F]$$

Typical values are C=100..500pF for small antennas.

However, better estimates are obtained by experimentation. Connecting the antenna to a reader, varying the capacitor and watching for maximum power consumption or maximum antenna voltage leads to good results.

This experimental procedure can be described as follows:

1. Connect a capacitor 100pF...330pF and a trimmer 6-120pF in parallel to the antenna and connect this to the reader. The wires between antenna and capacitors should be short, the wire to the reader should not form any loops. Vary the capacitor and watch for maximum reader supply current (mA-meter) or maximum antenna voltage (oscilloscope, low input capacity probe).
2. For the fine adjustment the reader has to be fully operational with the LED and a PC connected. Disconnect the oscilloscope probe from the antenna. Adjust the capacitor to get the best reading on page 0 (after power up or after the command C00) using a Read/Only or a Read/Write tag. Check, if it also reads well with a read-write tag on page 04 (command C04).
3. Measure the value of the best capacitor combination determined before and replace it by SMD capacitors, NP0/100V plus eventually an SMD trimmer 5-20pF/100V. The fine tuning in production can be done using this trimmer proceeding as described in step 2.



Antenna	Tuning Capacitor	Parts List / RS Components
35 mm \varnothing round	1 x 100pF/100V COG $\pm 5\%$ 2 x 47pF/100V COG $\pm 5\%$	737-645 126-449
37 x 50 mm	1 x 220pF/100V COG $\pm 5\%$ 1 x 33pF/100V COG $\pm 5\%$	737-667 126-433
45 x 69.5 mm	1 x 220pF/100V COG $\pm 5\%$ 1 x 33pF/100V COG $\pm 5\%$	737-667 126-433

All capacitors are size 1206, 100V, COG or NP0.

The functional principle is a parallel resonant LC-circuitry with the antenna coil forming the inductivity. The circuitry resonates near 13.56 MHz.

Capacitor tolerances may lead to reduced reader performance. For good results follow the following steps:

1. Measure the bigger capacitor (using a good RLC meter).
2. Adjust the smaller capacitor so that it adds up to the recommended values above. That is 192pF for 35 mm \varnothing round, 251 pF for 37 x 50 mm and 254 pF for 45 x 69.5 mm antenna.

A very general way to find optimum values of capacitors is:

1. Solder the biggest capacitor onto the antenna PCB and connect both to a MICROENGINE.
2. Put a trimmer capacitor in parallel to the capacitor and tune it to optimum performance
3. Replace the trimmer by fixed capacitors