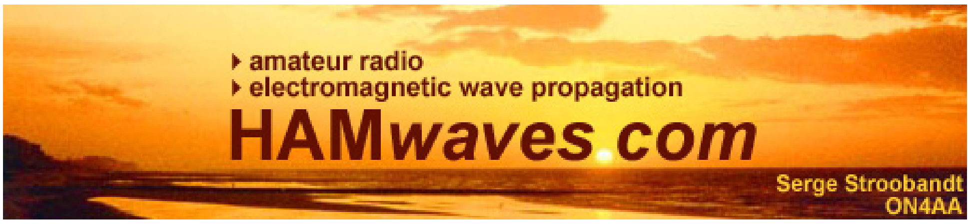
Antenna Notes



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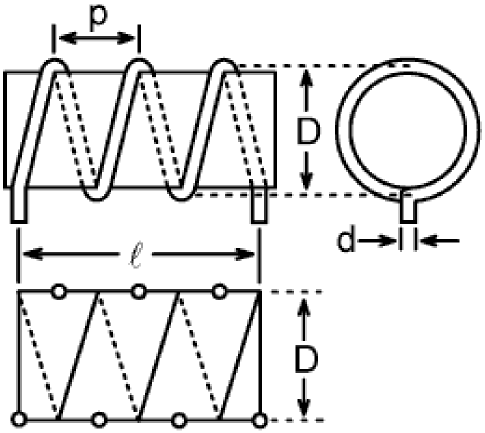
Last modified: 2 February 2015

Single-Layer Helical Round Wire Coil Inductor Calculator

ENTER:

Bobinage sur dia.11.5 mm

D = 13.5 mm	Mean diameter of the air core coil, measured from wire centre to wire centre	
N = 5.5	Number of turns	
ℓ = 19.45 mm	Lenght of the coil, measured from the connecting wires centre to centre	
d = 2 mm	Wire or tubing diameter	
Cu, annealed	Plating material	
ρ = 17.241 nΩ·m	Plating conductivity	
μ_r = 0.99999044	Plating permeability	
f = 51 MHz	Design frequency	



Round wire coil with dimensions and its current-sheet approximation[2]

Calculate Clear

INTERMEDIATE RESULTS:

p = 3.5363 mm	Winding pitch
Φ = 1.88542	Proximity factor according to empirical Medhurst data [2,3]
D_{eff} = 12.956 mm	Effective coil diameter according to Stroobandt (see below)

Correction factors:

k_L = 0.770031	Field non-uniformity correction factor according to Lundin[2,4]
k_s = -0.013098	Round wire self-inductance correction factor according to Rosa[2,5,6]
k_m = 0.226037	Round wire mutual-inductance correction factor according to Grover and Knight[2,7]

Wire:

$\ell_{wire,\ phys}$ = 234.072 mm	Physical wire length

$\ell_{wire,eff}$ = 224.716 mm — **Effective wire length**

δ_i = 9.25376 μm — **Skin depth at design frequency**

Sheath helix waveguide mode:

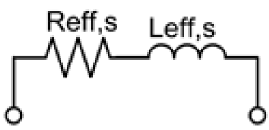
ψ = 4.96536 ° — **Effective pitch angle**

β = 4.67921 rad/m — **Axial propagation factor of n=0 sheath helix waveguide mode at design frequency**[1,8]

Z_c = 956.269 Ω — **Characteristic impedance of n=0 sheath helix waveguide mode at design frequency**[1]

RESULTS:

$L_{eff,s}$ = 0.20018 μH — **Effective series inductance at design frequency from Corum & Corum's sheath helix waveguide formula, corrected for field non-uniformity and round wire**[1,2,4-7]

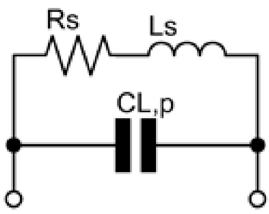


$X_{eff,s}$ = 64.1469 Ω — **Effective series reactance of round wire coil at design frequency**

$R_{eff,s}$ = 0.10326 Ω — **Effective series AC resistance of round wire coil at design frequency**

$Q_{eff,ul}$ = 621.159 — **Effective unloaded quality factor of round wire coil at design frequency**

Lumped circuit equivalent:



L_s = 0.18888 μH — **Frequency-independent series inductance from the current-sheet coil geometrical formula, corrected for field non-uniformity and round wire**[2,4-7]

$X_{L,s}$ = 60.5280 Ω — **Series reactance of round wire coil**

$R_{L,s}$ = 0.09194 Ω — **Series AC resistance of round wire coil at design frequency**

$Q_{L,ul}$ = 658.297 — **Unloaded quality factor of round wire coil at design frequency**

$C_{L,p}$ = 2.90864 pF — **Parallel stray capacitance at design frequency**[1]

Self-resonant frequency:

$f_{res,L}$ = 498.437 MHz — **λ/4 (parallel) self-resonant frequency of n=0 sheath helix mode**[1,8]

Frequently Asked Questions

In what does this inductance calculator differ from the rest?

The inductor calculator presented on this page is unique in that it employs the n=0 sheath helix waveguide mode to determine the inductance of a coil, irrespective of its electrical length. This allows for more accurate inductance predictions at high frequencies. Furthermore, the calculator closely follows the National Institute of Standards and Technology (NIST) methodology for