LC Oscillator Frequency: Colpitts, Hartley and Tank

Oscillation frequency of an LC tank, a Colpitts oscillator with a capacitive divider or a Hartley oscillator with a tapped inductor, with the feedback ratio.

Method: Resonant frequency of LC oscillators

Input parameters

Unit system: SI

Parameter	Value	Unit
Oscillator	Colpitts (C_1, C_2 in series with L)	
Inductor L (or L_1 for Hartley)	10.000	µH
Second inductor L_2 (Hartley)	2.0000	µH
Mutual inductance between L_1 and L_2 (Hartley)	0	µH
Capacitor C (or C_1 for Colpitts)	470.00	pF
Second capacitor C_2 (Colpitts)	1,000.0	pF

Calculated results

Parameter	Value	Unit
Oscillation frequency	2.8147	MHz
Equivalent inductance	10.000	µH
Equivalent capacitance	319.73	pF
Feedback ratio (Colpitts C_1/C_2, Hartley $(L_2 + M)/(L_1 + M)$)	0.47000	

Notes for this case

- $f_0 = 1/(2\pi\sqrt{L_{eq} C_{eq}})$ for an ideal, lightly loaded tank. Device and stray capacitances lower the frequency slightly; the loop gain must exceed $1/\beta$ to start oscillation.

Formula and method

$$f_0 = \frac{1}{2\pi\sqrt{L_{eq}C_{eq}}}, \quad \text{Colpitts}: \; C_{eq} = \frac{C_1 C_2}{C_1 + C_2}, \quad \text{Hartley}: \; L_{eq} = L_1 + L_2 + 2M$$

Variables

type	Oscillator	-
L_1	Inductor L (or L_1 for Hartley)	H
L_2	Second inductor L_2 (Hartley)	H
M	Mutual inductance between L_1 and L_2 (Hartley)	H
C_1	Capacitor C (or C_1 for Colpitts)	F
C_2	Second capacitor C_2 (Colpitts)	F
f_0	Oscillation frequency	1/s
L_{eq}	Equivalent inductance	H
C_{eq}	Equivalent capacitance	F
β	Feedback ratio (Colpitts C_1/C_2, Hartley $(L_2 + M)/(L_1 + M)$)	-

Method and standards

LC resonance.

Assumptions and limits

- Ideal lossless tank; feedback network lightly loaded.

References

Resonant frequency of LC oscillators

Report details

Report reference	FCC-TH68-KG1E (the same inputs always give the same reference)
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/electrical/electronics/lc-oscillator-frequency

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.