

# Designing Oscillator for an Antenna at $\sim 3.5$ GHz

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## Milestones completed so far

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## List of Milestones completed

- Created test schematic for oscillator using an ideal transistor
- Ran LTSpice Simulations for the ideal version
- Selected an RF transistor with a required performance at the interested frequency
- Ran PSpice Simulations for the same schematic but with non-ideal transistor
- Collected useful data like S-parameters, Z-parameters,  $Z_{in}$  and  $Z_{out}$  in order to build matching network
- Built matching network for  $Z_{out}$  and  $Z_{load} = 50[\Omega]$  at  $\sim 3.5[GHz]$
- Tested the power output of the circuit for the matching and adjusted the values to maximize power transfer between the DC sources and  $Z_{load}$

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# Topology of Ideal Transistor Circuit

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# Collpit's Oscillator

- The non-feedback Collpit's version was used for better performance at high frequencies
- The circuit was tested with no load attached
- Values of  $L_p$ ,  $C_1$  and  $C_2$  were computed using the operating frequency formula

$$f_c \approx \frac{1}{2\pi \sqrt{L_p \frac{C_1 C_2}{C_1 + C_2}}}$$

<sup>a</sup>

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<sup>a</sup>Full Derivation in the Appendix

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# Output Waveform

# Choosing the BJT

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## Required characteristics





# Testing with Load and Choosing a Matching Network

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## Next Steps

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# Appendix

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## Proof of operating frequency

# BFP520 Spice File

```
*$
.SUBCKT BFP520/INF 200 100 300
L1 1 10 0.47nH
L2 2 20 0.56nH
L3 3 30 0.23nH
C1 10 20 6.9fF
C2 20 30 134fF
C3 30 10 136fF
L4 10 100 0.53nH
L5 20 200 0.58nH
L6 30 300 0.05nH
Q1 2 1 3 BFP520
.ENDS
.MODEL BFP520 NPN(
+ IS =1.5E-17      NF =1          NR =1
+ ISE=2.5E-14      NE =2          ISC=2E-14
+ NC =2            BF =235        BR =1.5
+ VAF=25           VAR=2          IKF=0.4
+ IKR=0.01          RB =11         RBM=7.5
+ RE =0.6           RC =7.6        CJE=2.35E-13
+ VJE=0.958         MJE=0.335      CJC=9.3E-14
+ VJC=0.661         MJC=0.236      CJS=0
+ VJS=0.75          MJS=0.333      FC=0.5
+ XCJC=1            TF=1.7E-12     TR=5E-08
+ XTF=10            ITF=0.7        VTF=5
+ PTF=50            XTB=-0.25      XTI=0.035
+ EG=1.11)

```

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## Calculation of matching network

# Bibliography