



Designing Oscillator for an Antenna at ~ 3.5 GHz

2896

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Milestones completed so far

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

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

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

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^aFull Derivation in the Appendix

Output Waveform



Choosing the BJT

Required characteristics



Testing with Load and Choosing a Matching Network



Next Steps

Appendix

Proof of operating frequency

BFP520 Spice File

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*$
.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