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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

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

[a]

[a] Full Derivation in the Appendix

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Ouput Waveform

Choosing the BJT

Reqired characteristics

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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)
**********************************************************************
*$
```

Calculation of matching network

Bibliography