HOMEBREW RF SIGNAL GENERATOR

Block Diagram

Hartley FET Oscillator → FET_Follower → Adjustable Gain Amplifier → Emitter Follower

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The Reason
Even though I was able to find analog RF generators on Ebay for less than the cost of the parts to build my own, I decided that it would be a good learning experience in both theory and the art of using Manhattan construction.
The Target
I chose the following design goals:

- Frequency Range
  - 500 Khz to 20 Mhz.
  - This would cover the AM band up to the limit of my oscilloscope
- Power
  - Adjustable Up to 2Vp-p into a 50 Ohm to infinite ohm load
- Frequency stability etc
  - None
  - I hope to find time to build a DDS oscillator in the future
    - I have done this please see my FCC2 project.

Step 1 Picking The Active Device Type
After a web search including the links below


and a book search I had found several different designs, most used FET’s and others used BJT’s. CRYSTAL SETS TO SIDEBAND © Frank W. Harris 2006, REV 10

[http://www.qsl.net/k3pd/book.html](http://www.qsl.net/k3pd/book.html) chapter 10 recommends FETs for their frequency verses temperature stability and I suspect this is why I found more circuits using FETS.

I simulated and built two similar circuits one a Clapp BJT Oscillator \(^2\), and the other using a Colpitts FET Oscillator \(^3\) The FET harmonic noise level was lower than the BJT circuit in both simulation and from real circuits. From this limited experimentation I chose to use an FET as the active device for the oscillator because provides a purer signal with less energy in the Harmonics.

Step 2 Picking The Oscillator Type
At first I chose the Colpitts topology. After some experimentation, it became obvious that both halves of the leg that is taped for feedback would need to be variable to cover a large frequency range. I though this would easier to accomplish using a 2 gang Air variable capacitor. I ordered the capacitor and continued my experimentation several different fixed capacitors while I waited for the order.

When the part finally arrived I discovered that the two gangs had a common node which was also the frame. This node would need to be the feed back node. This meant that the frame would need to insulated from ground. I also found out that that even in this configuration the capacitance from my body when I touched a non-conductive knob on the shaft was changing the frequency.
Step 3 Changing the Oscillator type to Hartley

At this point I decided to give a Hartley oscillator a try. This effort was not without its rewards. I learned quite a lot as the section titled “What I learned from this design” shows. I hope to find time to build a DDS oscillator in the future.

Results

- Frequency Range
  - Target: 500 Khz to 20 Mhz.
  - Actual: 690kHz to 27.13 Mhz
    - Not met at lower frequencies, exceeded at higher frequencies

- Power
  - Target: Adjustable Up to 2Vp-p into a 50 Ohm load
  - Actual: Adjustable 0.7V to 3.32 volts
    - Not met at higher frequencies, exceeded at lower frequencies.
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Photos
Possible enhancements

- The frequency adjustment is too coarse. A small trimmer cap would be a good idea
- A pretty panel would be nice

References