

ZAPPER TROUBLESHOOTING HINTS

On some sets, (ex.2816 chip in Teaberry XII) the High and Low Frequencies lock in on transmit with a slight "tweak" of the VCO Coil. But then you notice receive is not in lock on the lower 20 channels and you wonder why.

After a little bit of analyzing the synthesizer, you find your answer. The RX and TX VCO frequencies are not the same-VCO RX is 455KC lower than VCO TX, due to the T/R switching built into the divider chip.

FREQ.	VCO RX	VCO TX
26.515	15.820	16.275
26.955	16.260	16.715
27.405	16.710	17.165
27.855	17.160	17.615

VCO frequencies are easy to calculate. In our example:

VCO TX = Channel Frequency-10.240 (26.515-10.240=16.275)

VCO RX = VCO TX - .455 (16.275-.455=15.820)

Now that we have identified the cause of the problem, what can be done about it?

Since we know the following formulas we can calculate the capacitive and inductive values at resonance.

$$X_C = \frac{1}{2\pi FC}$$

$$X_L = 2\pi FL$$

At resonance $X_L = X_C$ so $2\pi F_R L = \frac{1}{2\pi F_R C}$

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This transposes to (trust me on this one!)

$$F_R = \frac{1}{2\pi\sqrt{LC}} \text{ or } \frac{.159}{\sqrt{LC}}$$

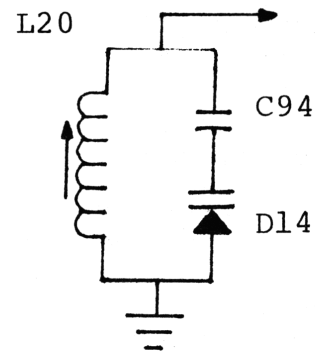
$$C = \frac{1}{(2\pi)^2 f_r^2 L} = \frac{1}{4\pi^2 f_r^2 L} = \frac{.0254}{f_r^2 L}$$

$$L = \frac{1}{(2\pi)^2 f_r^2 C} = \frac{1}{4\pi^2 f_r^2 C} = \frac{.0254}{f_r^2 C}$$

The main thing that I want you to see from the above formulas is that if you increase either the inductance (add more turns to VCO Coil) or the capacitance in the tank circuit you will lower the resonant frequency!

Now here is what we have, using our Teaberry Stalker XII example again.

D14 has a capacitance of approx. 22 pf @ 4V. C94 has a capacitance of 47 pf from the factory. By changing C94 from 47 pf to 53 pf we were able to get our VCO_{RX} to lock in at 15.820 (26.515)



That was all there was to it.

The LC7120, TC9102, TC9103, among others, have the T/R function so be careful of a dual VCO frequency on these! Also, sometimes the T/R function is not built into the chip but will have a separate T/R switching transistor.