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CERAMIC RESONATOR VFO

Designed By Prof. Mani T.K

The circuit explained here is very good to use as a VFO for transmitter and for DC receiver in 7 MHz ham band . The circuit is simple to construct and is highly stable as compared to LC oscillator , Since there is no tank circuit . Fig.1.1 give she circuit of the ceramic resonator variable frequency oscillator. The alignment procedures of the circuit explained here also is very simple .

The circuit consists of three stages.

1. Ceramic resonator stage .
2. Frequency doubler stage .
3. Amplification stage .

1. Ceramic resonator stage .

The design is simple and this stage is working as a colpits oscillator . The frequency of the ceramic resonator is variable from 3.5 to 3.6 MHz . This is achieved by varying the capacitance of PVC 2J capacitor connected in series with the resonator .

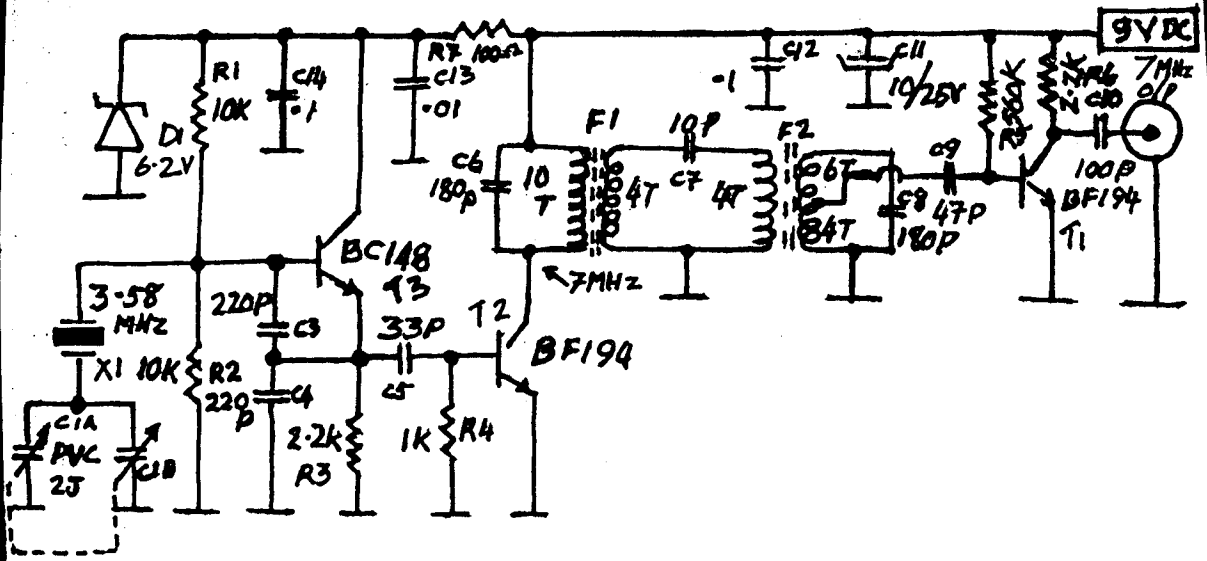


FIG.1.1 CIRCUIT DIAGRAM OF CERAMIC RESANATOR VFO

2. Frequency doubler stage .

The stage after the resonating section is the doubler section . Here transistor T2 is biased as a class c amplifier and the collector tank circuit is tuned to 7 MHz .The output of the tank circuit is again tuned and goes to the next stage .

3. Amplification stage .

The input of the amplification stage comes from the doubler stage . The incoming signals is amplified and the output is obtained from this section . The output from the amplifier stage will be clean signals whose frequency can be varied from 6.99 MHz to 7.12 MHz. (The specified range slightly varies with the type and make of the ceramic resonator used) .The transistors used in this circuit are all NPN small signal type . You can also substitute any high frequency NPN transistor also . The out put impedance of the circuit is 50 ohm .

CONSTRUCTION

We have already seen the basic parts of the VFO and now let us go for the construction section. The construction of the VFO have to be started with the construction of the coils followed by other parts . .

Construction of the coils .

Construction of the resonator is simple and not complicated .

, But the difficult part is the winding and tuning of the coils used . The most suitable material suitable for the construction of the coils is the IFT core . You can make use of a discarded IFT of the TV receiver . If you are so particular to use a new one , get a 10.7 MHz IFT (455 kHz IFT's commonly used in radios will also work with a slight degradation in performance) . Even if it is a new or old , our construction procedures are the same .

Start with removing the metal cabin of the IFT . Be careful not to damage the core and associated parts . You can do it in a better way using a small screw driver and a player . Remove the coils from the core and wind the coils as per the data given in the table A given below .

Table A

Coil ID .	Description .
F1	Primary - 10 turns Secondary - 4 turns . The coil has to be wound over an 10.7MHz IFT (See construction & circuit section) using 38 SWG winding wire .
F2	Primary - 4 turns Secondary - 10 turns with tap at 4 turns from the cold end . wind the transformer on the IFT core using 38 SWG winding wire .

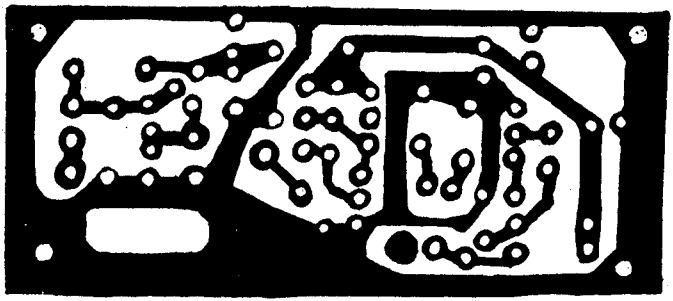


FIG 1.2 PCB DESIGN FOR VFO

Assembling of the components .

For the assembling , you can use a PCB constructed using the art work given in fig . 1.2 . I recommend you to use a good quality glass epoxy pcb for the construction . Glass epoxy will ofcourse offer you a good frequency stability and reliability .

The PVC 2J gang need not to be mounted on the pcb . You can fix it in a convenient place on the cabinet used . You can also use a general purpose PCB provided it go in tune with the RF tracking rules and others .

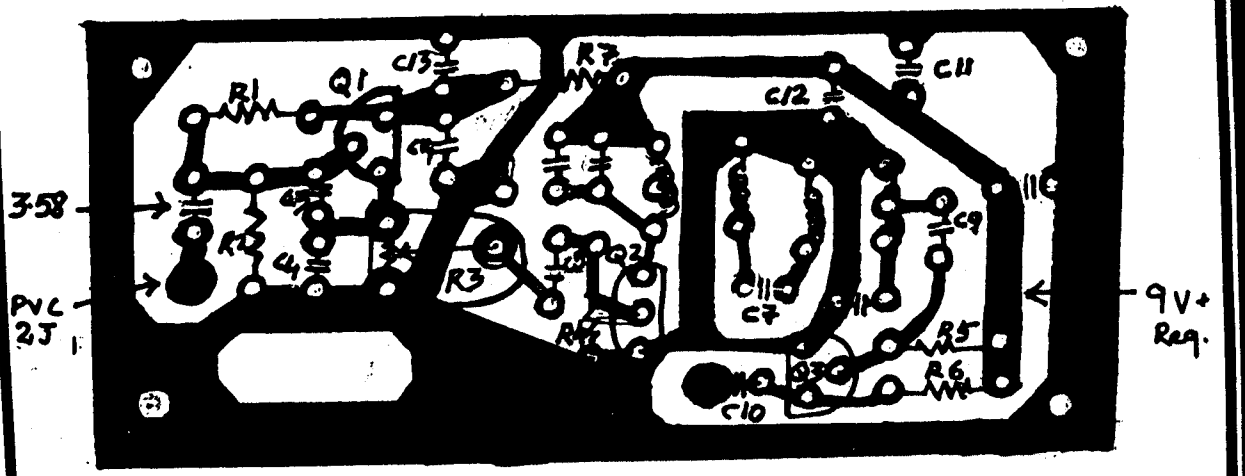
It is a good practice to fix the coils first . It helps you to fix the room needed for the coils . Then go for the resistors , capacitors etc. . Fix the transistors and other heat sensitive parts in the last round . Don't over heat the tracks and cut out the projecting leads of the components . Always fix the components in such a way that there lead length are to the minimum .

After assembling the pcb , clean the pcb with a good cleaning solutions such as sopropyl alcohol . You can also use of good quality spirit or oilless petrol . This cleaning helps us to remove the stains of flux , dust etc. from the track .

TESTING AND ALIGNMENT.

Testing .

Double check the wiring and soldering wrong placement of the components , solder bridges and brakes . Apply



COMPONENT LAYOUT

power to the circuit and check for the voltages as per the table given in the table B given below . Note that the -VE lead of the multimeter should be grounded for the tests .

Test point	Voltage
T1 Collector	6 V
T1 Base	2.6 V
T1 Emitter	2 V
T2 Base	0
T2 Collector	Less than 6 V

Table B.

If the voltages are OK , then check for the output .You can check the output RF signals by using a RF probe . (see for the simplified circuit of the RF probe in appendix .).

You can also check the output without using an RF probe . Using a good receiver placed near to the VFO and tuned around 3.5 MHz and 7MHz , will receive the VFO signals from our resonator .

Alignment .

It is always recomended to use an RF probe and a frequency counter for the alignment of the coils . Measure the output frequency and it should be any were in between 7.00 to 7.100 MHz . Now tune F1 to get a maximum deflection in the RF probe .Then tune the variable capacitor in the VFO to get a frequency counter

reading of 7.05 MHz . Now adjust the IFT coils to get maximum signal strength .

Tune the VFO using the variable capacitor , starting from minimum to maximum and the RF probe reading should indicate a steady strength for the entire frequency range . If the signal strength increases or decreases with the tuning , Alignment of the F1 and F2 have to conducted once more . A ootaggered tuning of F1 and F2 will solve this problem

Points to note :

1. Battery operation is preferred. For battery operation of VFO, remove the zener diode Z. If Zener diode is omitted, the total current drain from battery to the V.F.O. will be about 8 M.A.
2. Never use ordinary yellow disc capacitors. The V.F.O will not oscillate.
3. If silver mica capacitors are available, use that instead of styroflex capacitors.
4. V.F.O on/off switch is optional.
5. Always keep V.F.O. away from 5 Hz mains transformer to avoid hum pick-up. A distance of 2 feet will do.
6. Use home made P.C.B. or ready made vero board for assem bling the circuit.
7. V.F.O should be enclosed in an iron sheet box. A standard 6 volt eliminator box is suffice .
8. Use rigid copper wiring in the V.F.O. assembly to avoid frequency shift. Never let it loose.

COMPONENT DETAILS OF V.F.O

No.	Item ID.	Description.
Resistors		
1.	R1	10 K 1/2 W
2.	R2	10 K 1/2 W
3.	R3	2.2 K 1/2 W
4.	R4	1 K 1/2 W
5.	R5	560 K 1/2 W
6.	R6	2.2 K 1/2 W
7.	R7	100 Ohm 1/2 W
Capacitors.		
1.	C1 A	PVC 2 J
2.	C2 B	
3.	C3	220 P Ceramic disc
4.	C4	220 P Ceramic disc
5.	C5	33 P Ceramic disc
6.	C6	180 P Ceramic disc
7.	C7	10 P Ceramic disc
8.	C8	180 P Ceramic disc
9.	C9	47 P Ceramic disc
10.	C10	100 P Ceramic disc
11.	C11	10 uF , 25 V Electrolytic
12.	C12	.1
13.	C13	.01
14.	C14	.1
Transistor , Diode , Xtal , Coils etc .		
1.	T1	BF 194 or Equalent
2.	T2	BF 194 or Equalent
3.	T3	BC 148 or Equalent
4.	D1	6.2 V Zener
5.	X1	3.58 MHz Ceramic resanator.
6.	F1 & F2	See Table A .