CK217 - 9V FM TRANSMITTER

This is an improved CK200. At first sight it looks similar to the original CK217 – especially the inductor etched onto the PCB – but it has been tinkered with by Harry Lythall in Sweden to give the best distance and stability for its size.

The battery supply rails have been well tied together with respect to radio frequencies (C1, C2 and C7.) The tracks are also thicker. This makes the circuit a single 'solid' block eliminating RF currents in different parts of the circuit. This also means the battery no longer has RF on it which makes the whole unit a lot more frequency stable.

C6 – new component. The trimmer capacitor is 2pF – 30pF and is much to high a capacitance range to cover just 98MHz +/- 10%.

C5 – 2p7. Reduced from the old 10pF. The old component had to much capacitance preventing the transmitter from operating above 100MHz. If you find the upper frequency is to high (like 112MHz) then increase the value to 3p3.

C1 & C2 – new components for supply decoupling. To force the supply rails to become an RF ground/earth there should be more than one decoupling capacitor. Electrolytic caps have resonances in the VHF region. The physical position of the ecaps on the PCB is very important.

C3 - Changed from 4n7 to 10nf. The LF response "filled out" a little more and sounds better on the air. C2 is also probably operating to damp the HF response, but for general microphone use this is not a problem. It probably adds to the overal RF stability.

C4 - Changed from 4n7 to 3n3 - it allows the upper frequency response to become over 12KHz.

R4 - R3 - Biasing changes to the AF amplifier transistor. This now gives a more stable bias arrangement that is less dependant upon transistor characteristics. It is important that TR1 is stable - changes in bias affect the frequency range and modulation depth.

R2 - 100K - New component - This works together with R3 to form a voltage divider to prevent overmodulation. With 100K the complete project is sensitive to a normal conversation at 1/2 metre distance. Here are some suggested line level input levels and resistor values:

R2 = 47K - Conversational voices at 5m to 15m (3m minimum)
R2 = 100K - Conversational voices at 0.5m to 5m
R2 = 470K - Conversational voices at 0.2m to 0.5m
R2 = 2M2 - Line input level (computer LINE OUT, also remove R1. Open circuit.)
R2 = 100K - Conversational voices at 300mm using low-level dynamic mic (also remove R1. Open Circuit.)
R2 = 470K - Magnetic guitar pickup (also remove R1.)

The frequency determining elements (L1, C5 and C6) form a simple LC tuned oscillator. The inherent problem with this type of circuit is that any external load (antenna) will change the operating frequency. This is normal. If the antenna load is heavy then the transmitter could be moved off frequency by 1MHz, or perhaps even more.

The tuned coil, L1, has two output tappings for the antenna connection, marked "A" and "B". These are both low-level outputs and you choose which tapping you want to use. Most other kits of this type have fixed output tappings, so you must accept either unstable frequency or low range, whichever the designer has chosen for you.

Tap A (2.5%) takes just a very small portion of signal from the oscillator circuit and therefore gives a very frequency stable transmitter. The output level and range are therefore somewhat reduced.

Tap B (10%) delivers very much more power to the antenna load. This gives you **a greater range**, but at the expense of frequency stability. Touching the antenna wire will therefore have a noticeable effect on the transmitter frequency.

When assembling the project, take care to fit even the resistor orientation as shown on the component overlay. Although resistors are symetrical and non-polarised, vertical mounting makes them become asymetrical: one lead is longer than the other. This can alter VHF circuits by adding greater capacitance to other components. All component leads should be keps as short as possible. The LINK wire on the PCB should lay flat on the PCB. Use the cutoff from a resistor.

Antenna length. This varies with frequency for optimum distance. 90MHz 80 cm, 95MHz 75cm, 100MHz 70 cm, 105 MHz 68 cm.

Supply Voltage. This is limited by the voltage rating of the ceramic capacitors to 16VDC. If you use an external supply a regulated one is best.

Operation. When you connect the power to the ssembled kit make sure to take the receiver at least 10 m away from the transmitter so as not to pick up harmonics. The frequency range of the fundamental should be about 89MHz – 109MHz. Output power is about 9mW at 9V, antenna tapping B. Tapping the antenna at A should approximately triple the range.

For a review of the theory behind two and three stage FM transmitter circuits download

http://www.crowcroft.net/kitsrus/fmtx.zip

It is 1.1MB and has the full theory of operation behind this circuit.

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COMPONENTS		
Resistors 5%, 1/4W.		
100R brown black brown	R7	1
1K brown black red	R5	1
22K red red orange	R3	1
100K brown black yellow	R2 R4	2
12K brown red orange	R1 R6	2
Ceramic capacitors		
2p7	C5	1
3n3 332	C4	1
10n 103	C3	1
22n 223	C2	1
22p	C6	1
Electrolytic capacitors		
10uF/25V	C1	1
100uF/16V	C7	1
Microphone JinIn ECM-60P B1		1
0-30pF tuning capacitor		1
BC338		1
BC548B		1
K18V2 PCB		1
Aerial wire		1
9V battery snap		1