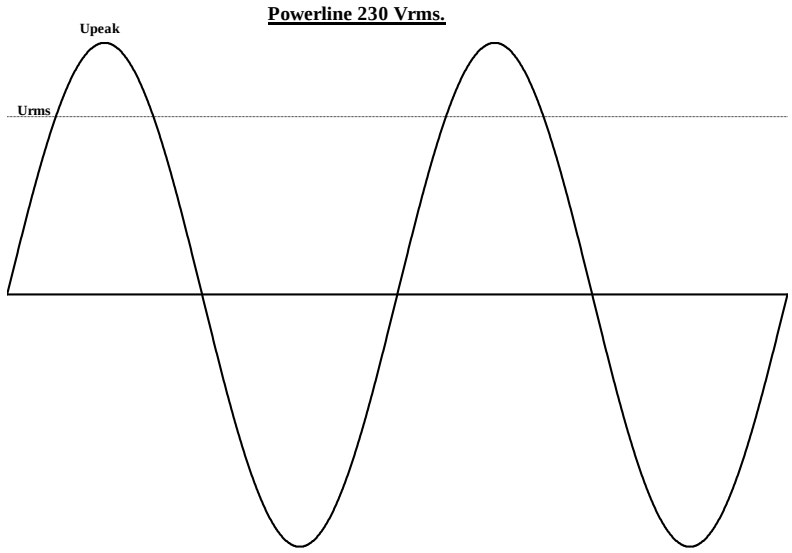
Oscillators.

Oscillators are used in electronics systems to produce a sine wave, a square wave or other shapes such as saw tooth, as an output. If you want to construct a transmitter it is normally to produce a sine wave output.



This sine wave is showing the output from the power line in your house. Oscillators used in radio frequency circuits are always very low power devices, in contrast to AC generators in power stations. Nevertheless, the AC power generator and the electronic are related, in that they both produce sinusoidal output.

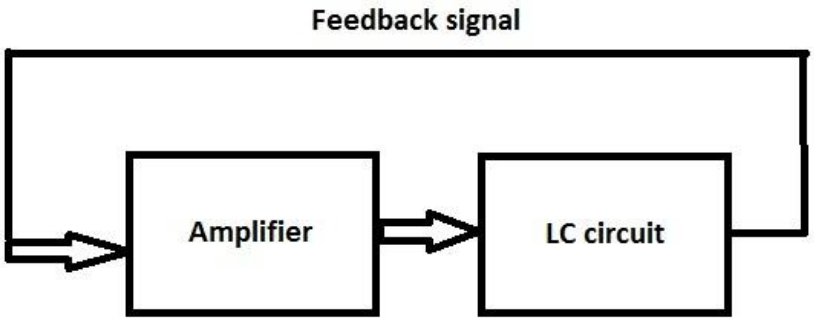
The electronic circuit can produce sine wave from 0.01 Hz to 100GHz, in principle from close to 0 to the highest possibly frequency, where you can get amplification.

An oscillator producing a radio frequency output is actually a low power transmitter in its basic form. In an actual radio transmitter and in receivers you have up to several or more oscillator's involved.

Requirements for oscillations:

The following are necessary if you want to make an oscillator.

a. Amplification on the oscillator frequency
b. A frequency determine device (LC circuit)
c. Positive feedback.(From output to input)



Amplification is necessary, because you have to put the signal back and amplified it again, until the oscillation start. This is sometimes a problem in a normally amplifier; because it can function as an oscillator, when you want it to be an amplifier.

It is specially a problem in an amplifier with LC components. It is because you always have both an inductive and capacitive part. So this is a resonance circuit, you do not want.

An example of unwanted oscillations is when you have a microphone, with an amplifier and a loudspeaker as output. If the microphone can "hear" the loudspeaker; it will "oscillate". This is normally a high LF frequency; which is very bad to listen to, because it is a very high sound.

Frequency determining device:

The frequency determining device is usually a resonant circuit; or a quart crystal slices taken from quartz crystals make the most stable oscillators.

Stability:

To have good stability, an oscillator should:

a. Have a high C-to L ratio
b. Have well regulated power supply
c. Have good isolation between the oscillator and its load
d. Use components which have low temperature coefficients.
e. Not to be used at large temperature changes.
f. Have good mechanically stability

Drift:

Drift is an unwanted slow change in the frequency output of an oscillator.

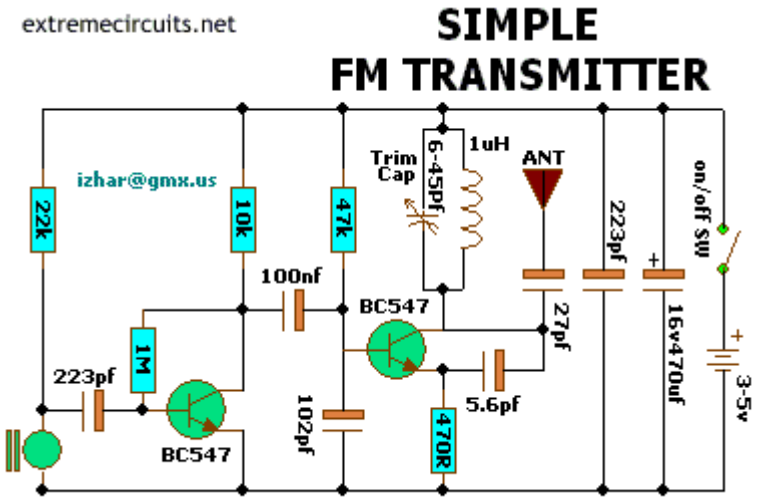
One of the main causes of drift in LC oscillators is unwanted capacitance changes in the circuits. It can be “hand capacity” and temperature change. If the tuning capacitance is made high compared to the inductance in the frequency determining circuit, then such capacity changes will cause a smaller percentages changes then if the tuning capacitance were smaller. Simply having a large capacitance compared to inductance produces a more stable oscillator; both in regards to mechanical rigidity and temperature effects. We say the stability is better with a higher C to L ratio.

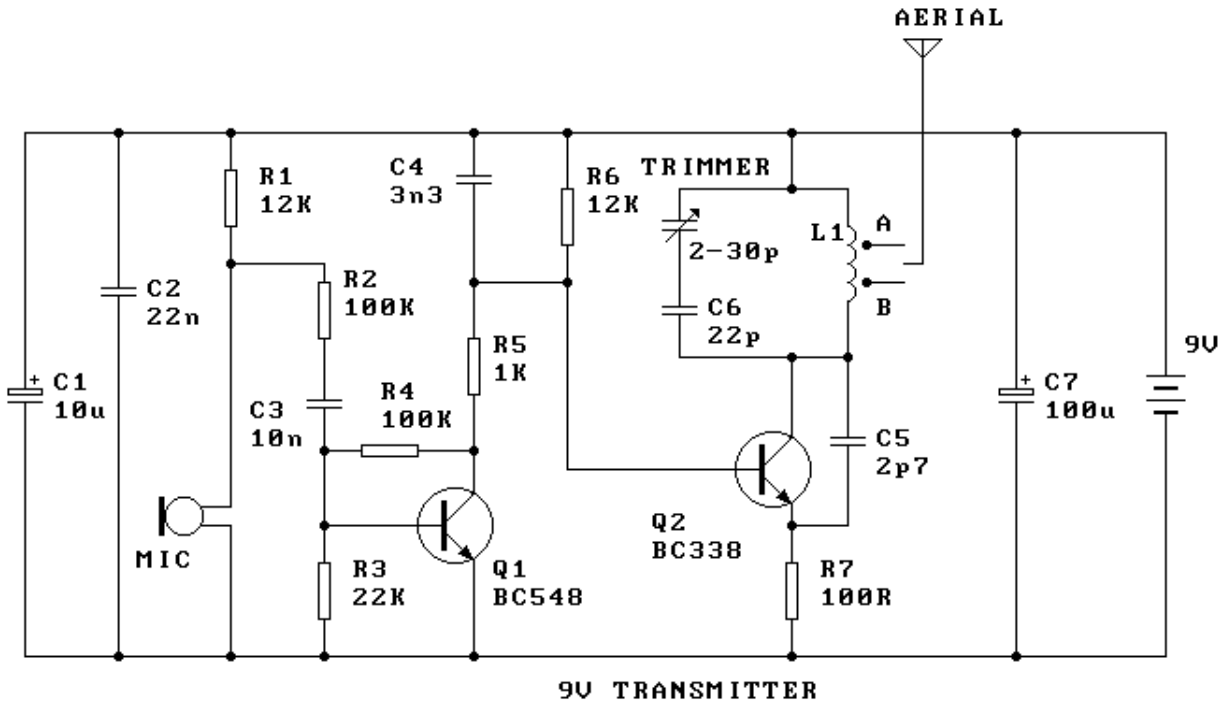
Oscillator types:

There are several types of oscillators

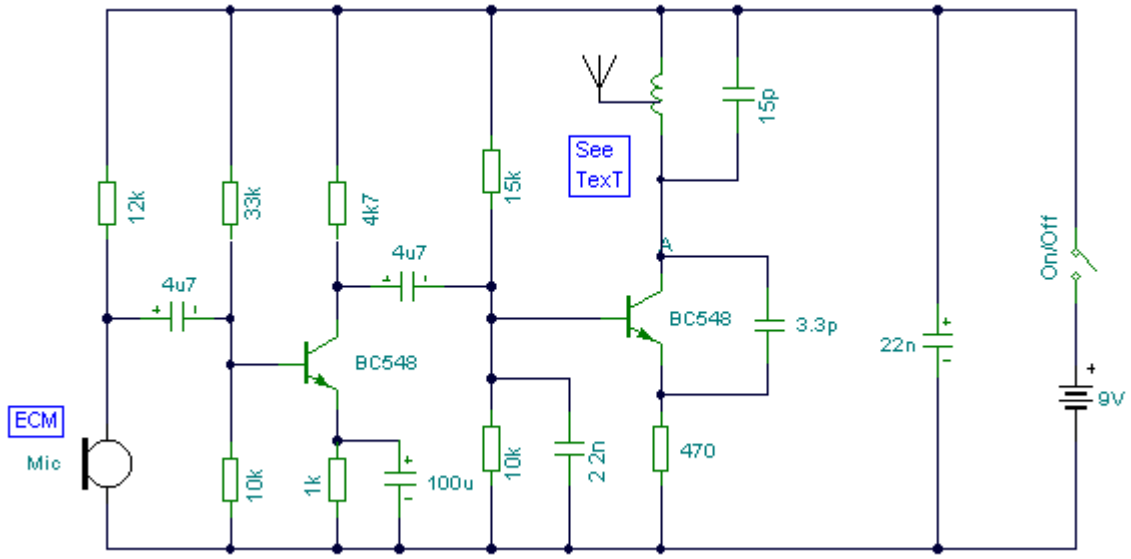
a. Colpitts oscillator
b. Hartley oscillator
c. Clapp oscillator
d. Pierce oscillator
e. Wien bridge oscillator
f. Other types.

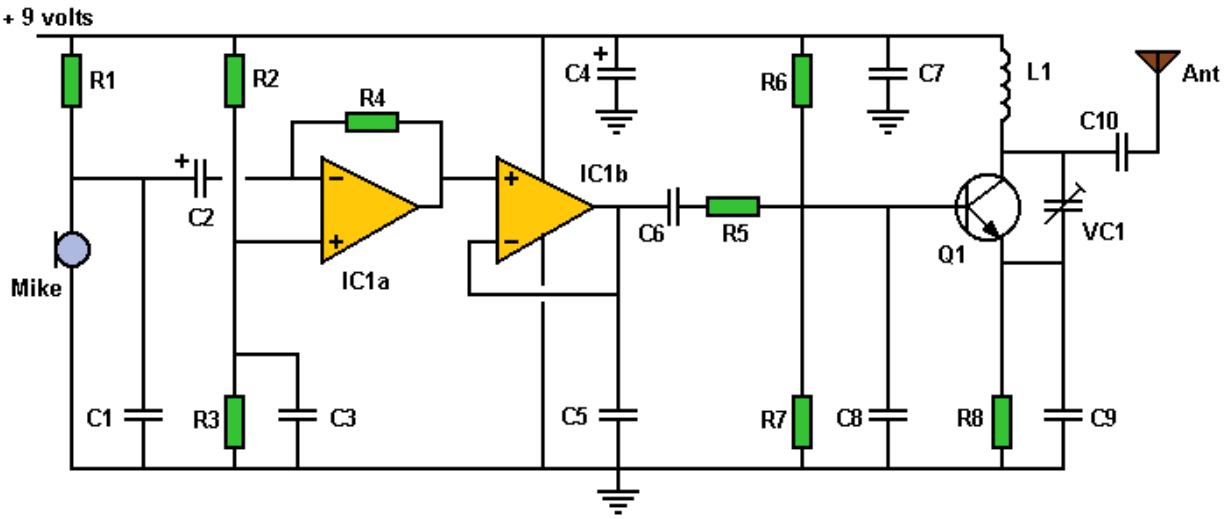
The following four examples of simple oscillators are found on the internet:





9V TRANSMITTER





Parts List

R1=4K7 R4=150K R7=3K9 R2=4K7 R5=220R R8=120R R3=4K7 R6=4K7

All resistors except R8 are at least 0.25W rated. R8 is at least 0.5W rated

C1=1n C4=22uF C7=10n C10=1n C2=4u7 C5=1n C8= 1n C3=1n C6=10n C9=33pF

VC1=5-60pF IC1=TL 072 Q1=BC547

Notes

L1 is 0.112uH (this tunes to the middle of the FM band, 98 MHz, with VC1 at its centre value of 33pF).

L1 is 5 turns of 22 swg enameled copper wire close-wound on a 5mm (3/16") diameter former. Alternatively, you can have a fixed 33pF cap instead of VC1 and have L1 as an adjustable molded coil (eg UF64U from Maplin). VC1 will give you a tuning range of 85 - 125 MHz, and a possible choice is the Philips type polypropylene film trimmer (Maplin code WL72P).

Two sets of oscillator bias resistors are given, the ones in the brackets give about 20% more RF power.

Mike is our favorite Omni directional sub-mini electret (Maplin code FS43W). Ant is a (lambda / 4) whip monopole (eg 76 cms of 22 swg copper wire).

Q1 is configured as a Clapp oscillator. Frequency modulation results from the audio voltage changing the transistor's base-emitter capacitance.

22 April 2012

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