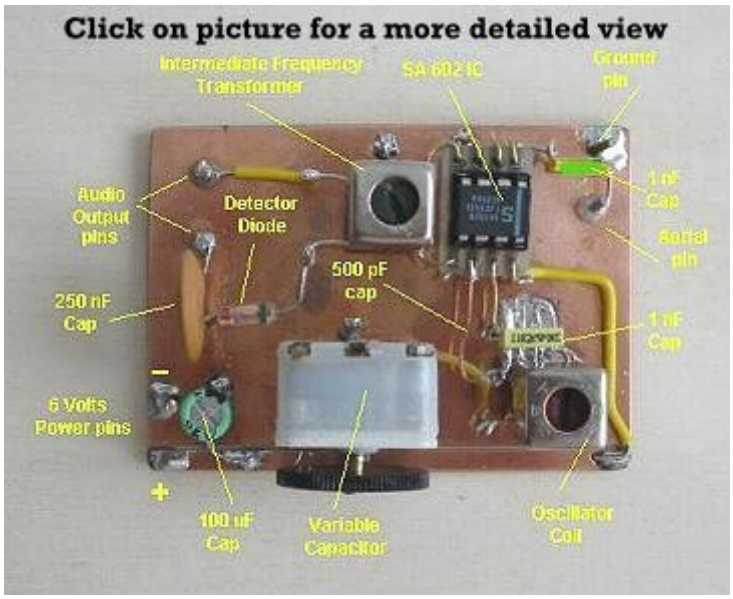
One Stage Superheterodyne Receiver with the SA602N integrated Circuit



If you ever dreamt of building a superheterodyne receiver, now you have the possibility of bringing to reality...your dream! And this is with a very 'simple-to-manage' integrated circuit, the SA602N.

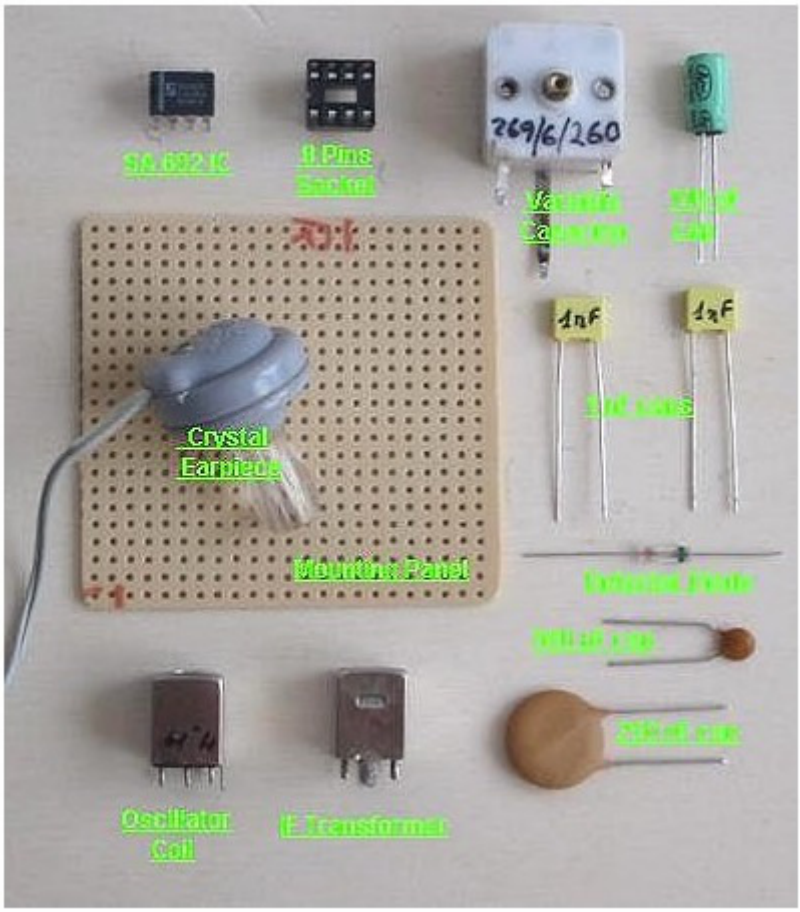
With this IC, you will build the simplest possible superheterodyne receiver, as it has only one stage. The normal commercial superhet that you find in the shops, have at least five or six stages. It begins with a mixer oscillator, then two intermediate frequency amplifiers, a detector an a final audio amplifier . Some of them even have a front end radio frequency amplifier.

On the contrary, our project counts only with one stage, the mixer-oscillator that is inside the SA602N IC.

A Single Diode Detects the Audio Signals

The detection of the audio signals is achieve by a germanium diode like the OA90 or any equivalent. The audio power delivered by this diode is quite small but enough to drive a high impedance phone. Magnetic earphones of that kind are exspensive, so I resorted to a crystal earpiece...very cheap and easy to find in most electronics' shops. Crystal earphones have a practically infinite impedance, very great resistance to audio currents, and they are like an open circuit or like a capacitor of only a few picofarads of capacitance. I have measured the capacitance of one of these units and found 1.5 nanofarads or 1500 picofarads. So, a crystal earphone is a peice of equipment quite practical when you have to deal with tiny audio currents...as it happens with our receiver.

How to Get the Coils for this Receiver



The main problem of building homebrew superheterodyne receivers is the construction of the required coils. A problem really difficult to overcome if you don't have equipment to measure inductances and enough patience to deal with wire and coil forms. To solve this problem for our simplest receiver, we will use already prefabricated coils taken from a discarded transistor commercial receiver. Surely you have one of these spoil receivers lost in some drawer around the house. The next step is to carefully disect this receiver and look for the oscillator coil and one of the intermediate transformers.

The Oscillator Coils

The oscillator coil is a small shiny metal case with a square base that measures 10 X 10 milimeters and 12 milimeters high. Inside this small box there is a ferrite nucleaus with two coils; one of them is center-tapped.

So this can has 5 pins. If you disect a discarded transistor ...one receiver to take out this can, be very careful because the base is plastic and if you apply too much heat with your soldering iron to the pins, not only will you take out the box, but also the pins out of its' plastic base.

There are at least 4 of these boxes like this in a cheap commerical transistor and we need only two. Each one has a round top hole to adjust a slug. These slugs are marked with a color to differentiate their functions, so we will take out the oscillator box, which is marked in red. We will also take out an intermediate transformer, which is marked in black. This particular box has a small capacitor introduced in the same plastic base.

Not everyone of us has an inductance meter in our laboratory to measure these coils. But with a resistance meter we can know which is each one of these coils. The oscillator coil has about 0.7 ohms between two of its' legs and about 4.4 ohms between the two other extreme legs. We do not use the center-tapped leg.

The Intermediate Frequency Transformer

The intermediate frequency transformer has the same disposition of pins like the oscillator coil...though different ohm values.

With this measurement, we can place these coils in the right place following the receiver schematic. A good practice is writting the ohm values on the faces of the cans above the corresponding pins. So you will not have doubts when mounting the cans on your receiver.

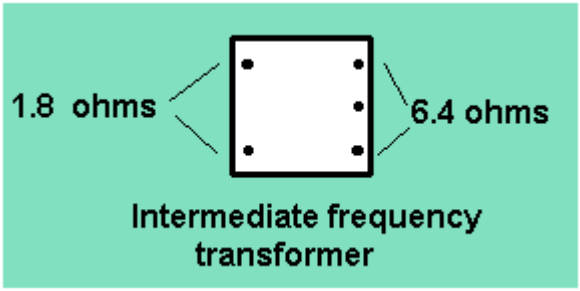
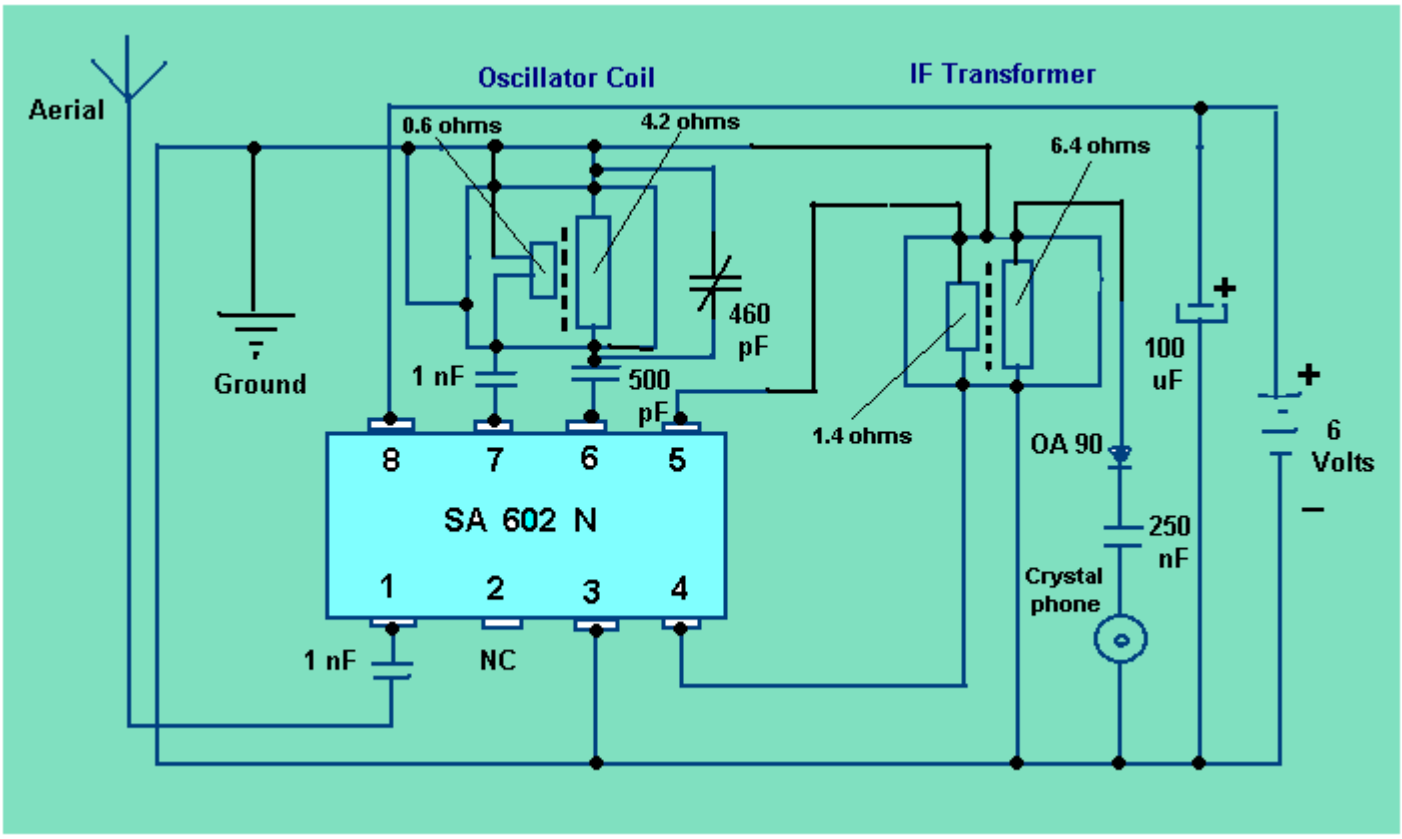


Diagram of the One Stage Superheterodyne Receiver With the SA602N Integrated Circuit



The Variable Tuning Capacitor

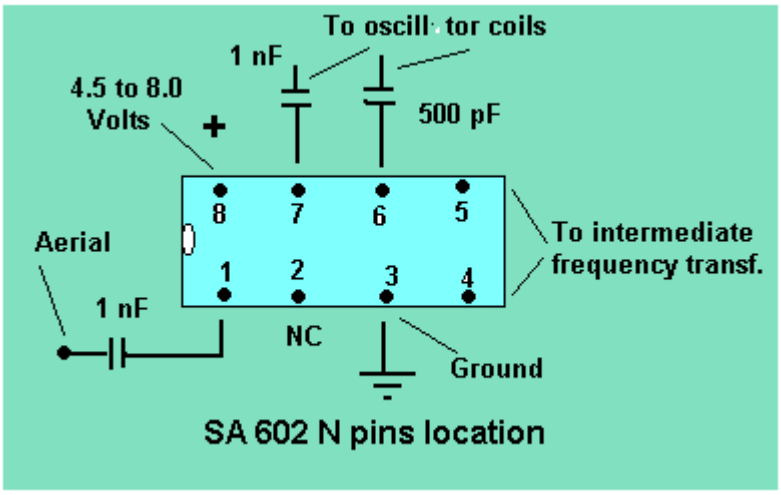
At the same time you take out the coils from a discarded transistor receiver...take out also the variable capacitor. This capacitor has two sections...one for the oscillator coil and the other for the tuning coil. We will use only the oscillator section of this variable capacitor, because of the simplicity of our one stage superheterodyne receiver.

The more specific components we need for this project, is these coils and the variable capacitor. All the others components are the normals used in an electronic circuit.

The Integrated SA602N Circuit

The integrated SA602N requires additional information. This IC is another masterpiece of modern electronics. In a small dual in-line capsule of only 8 pins, there is an oscillator circuit and mixer circuits. Years ago to acheive this, we needed one or two voluminous electronic valves or tubes, and a lot of circuitry...expending some precious watts of electric power. So let us take advantage of this intersting IC...which works with 4 to 8 volts and waste only 2.5 mA's.

Pin Orientation of the SA602N Integrated Circuit



Though the SA602N can work from 4 to 8 volts, the most appropriate voltage for this project is 6 volts. Pin #2 is not connected and the negative pole of the 6 volt battery is plugged to ground.

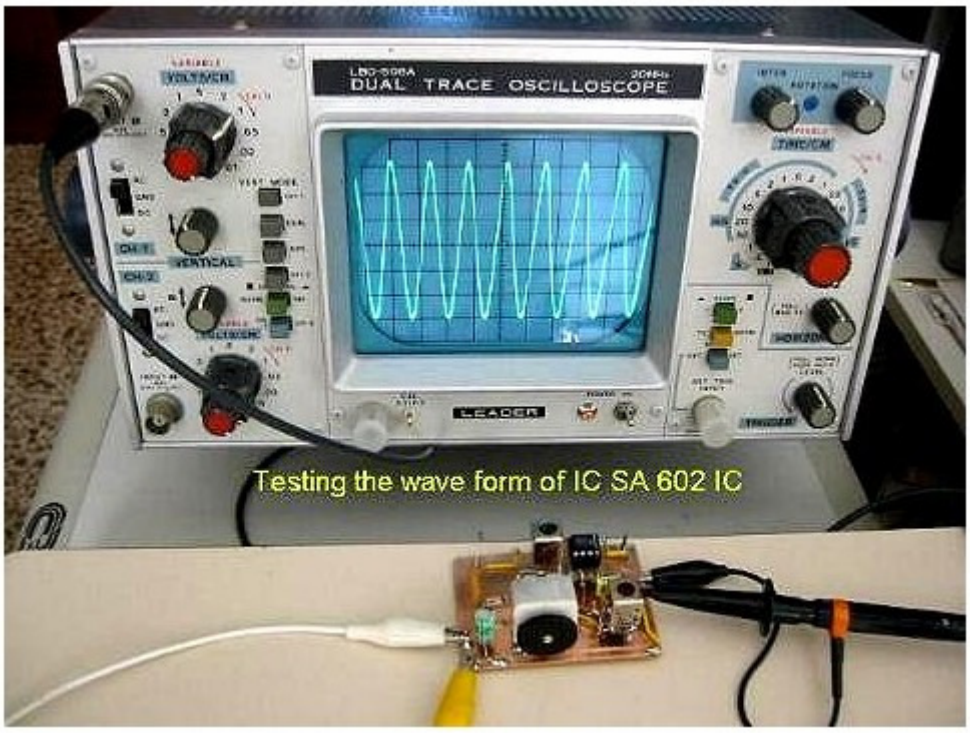
More technical and specific information about this intergrated circuit can be obtain from the data sheet of Philips Catalog on the internet.

To experiment with this integrated circuit, it is advisable to build this project first on a breadboard. The position of the components is not critical at the frequencies that the receiver works...from 550 KHz to 1600 KHz...which is the medium wave broadcast band. And once the receiver comes to life, you can mount it in a more permanent way and even introduce it in a cabinet and test its' performance in the open field.

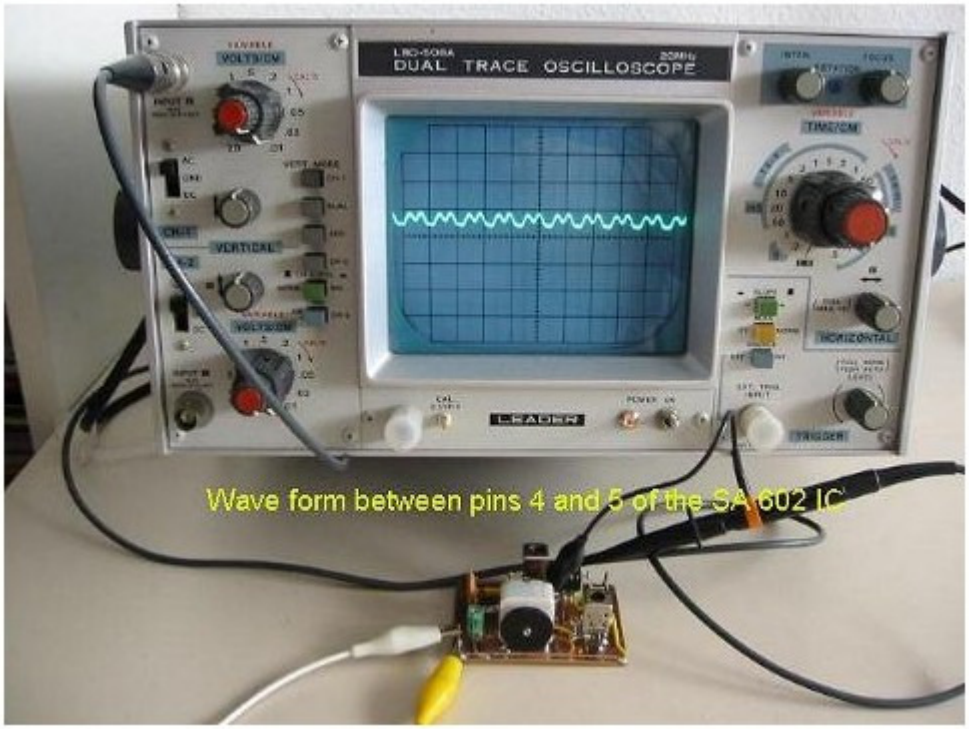
This tiny receiver works with an indoor antenna of 2 or 3 meters long. If you are so lucky of having an outdoor antenna, you can experiment with medium wave DX'ing, especially at night.

How to Test the SA602N Integrated Circuit

One point of capital importance is to know if the oscillator section of the IC works. If you have an oscilloscope, get the wave form from Pin #6 to Ground. It is a perfect sinusoidal wave, which is shown in the picture above.



Also, between Pin #4 and Pin #5, you can obtain the wave form in the picture to the right.



But not all electronic amateurs have an oscilloscope. What to do in this case? Quite easy, place a transistor receiver tuned to MW in a non receiving signal point...a few centimeters side by side with your project. Now, turning the variable capacitor, if your SA602N IC is working, you will hear some whistles or even a local station on your transistor set.

If you hear nothing, the oscillator is not working. What to do then?

Then reverse the connection of one of the oscillator coils and try again. That is why it is advisable to experiment with this project...first on a breadboard.

Finally, the SA602N IC opens a wide field of experimentation due to its' capacity to oscillate up to 200MHz. You can build with it short wave, FM and higher frequency receivers. This circuit allows also the building of direct convesion receivers.

With this one stage superheterodyne receiver project, you will be acquainted to an interesting IC that will surely bring you hours of fun in designing receivers to your own ideas!

Enjoy your time at the workbench and have plenty of success with all of your projects...

...your friend, Pedro