SW Converter for AM Radio

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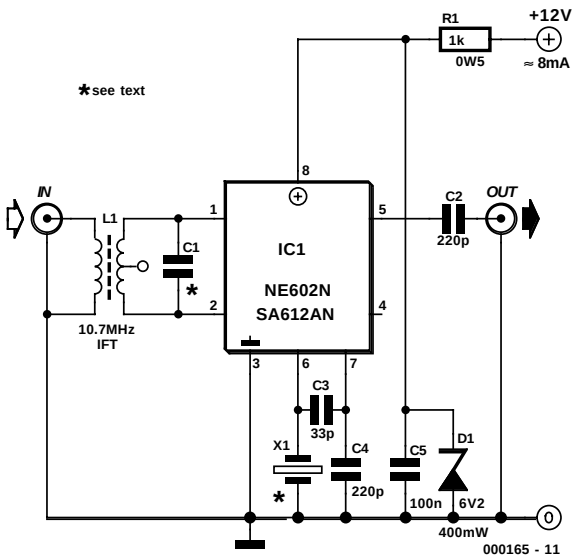
Apart from chucking it in the bin, what can you do with old AM car radio or clock radio in your junkbox? How about turning it into a crystal controlled, stable, short wave radio receiver, for a minimum investment in time and money? Read on.

The heart of the circuit shown here is an IC which goes by the name NE602, NE612 or SA612. It is a double balanced mixer that includes an oscillator that can be crystal-controlled, free running or even driven externally from a PLL, etc. It was originally designed for mobile telephones and is probably available in junked car phones from the tip.

The NE602/612 contains a differential input amplifier (called a Gilbert Cell), an oscillator/buffer, a temperature compensated bias network and a power regulator. Typical frequency response is in excess of 500 MHz for the input and 100 MHz for the oscillator. Supply current is 2.4 mA and the absolute maximum supply voltage is 9 V. Input and output impedances are approx. 1.5 kΩ.

As you can see from the circuit diagram, the input from the aerial is passed through a 10.7 MHz IF (intermediate frequency) transformer. This gives isolation from the aerial and reduces the effect of strong local AM radio breakthrough. The transformer can be salvaged from a dead FM radio or stereo or even the FM section of an old clock radio. (The AM section is what we want to use anyway so



ratting a bit from the FM section saves cost).

A number of 10.7 MHz IF coils from Toko and other far-Eastern manufacturers may be used, including the 94AES30465N and 94ANS30466N, but obtaining these as new parts may be more costly than a complete radio rescued from the tip. There is usually a small capacitor under the IFT coil, between the pins. If so, remove it by crushing it with a pair of pliers and ripping out the remains. The

capacitor is not needed as we add an external one according to the band wanted.

The input signal is fed into the balanced input of the IC. The crystal is connected to pin 6. It oscillates at its fundamental frequency and is mixed with the input signal giving a number of outputs.

The mixer output signal appears on pins 4 and 5. Here, only pin 5 is used for the output. By the way, the inputs and outputs are internally biased with pull-up resistors, so there is no need to tie the unused pins to ground or power. The 220 pF capacitor gives isolation to any DC into the AM radio aerial input. Note also that the same circuit can be used to extend the range of an existing short wave radio receiver in exactly the same manner. The AM radio is used as a tuneable intermediate frequency amplifier, with a tuning range of about 1.6 MHz.

You can try different values for C1 to get resonance at the NE602 input: 150 pF for up to 5 MHz, 47 pF for up to 8 MHz, and no capacitor for up to 10 MHz. In practice however 33 pF should do for all ranges.

Almost any crystal can be used. The author tried many types from FT-243 WW2 surplus ones to 27 MHz, 3rd overtone CB crystals. Every crystal tried worked. TV sub-carrier crystals work well, as do large oven types. Several crystals can be connected through a switch, giving a convenient way of switching bands. Keep the leads to the switch as short as possible though to prevent radiation of the crystal oscillator.

There are many ways to build the circuit. You could make it into an external metal box that can be connected to several radio's, depending on your location. For instance, if you are a traveller, make it in a small box with an internal 9-volt battery, and leave enough wire on the output to wrap a few dozen turns around the clock radio in your Hotel room. This will give you your short-wave reception on the go.

It is also possible to build the converter right into the car radio. Any sort of construction method can be used, from a small piece of perforated board that I used, to a more elaborate printed circuit board and even just lash all the small components underneath the IC socket. A small switch may be used to change from AM to short-wave.

Connect the circuit to the car radio with screened cable to prevent or lessen the effect of strong station breakthrough. To couple the output of the converter to a radio without an external AM aerial input, wind several turns of wire around the internal ferrite rod aerial. As suggested before, winding a dozen or so turns around the plastic radio case will also couple the converter to the radio. This will work at the expense of increased AM signal breakthrough.

Connect the positive power lead to the switch on the radio so that it switches the converter on and off as well.

The short-wave aerial can be 2 to 3 meters of wire strung around the room, but better results will be obtained with a outdoor aerial. The test aerial was about 100 meters long and 10 meters high.

At night there is a lot of activity on the short waves after dark. Find a weak station around 1 MHz on the AM dial and adjust the core of the IFT for minimum volume from the broadcast station. That's the only adjustment.

SSB signals can be heard, but as no beat frequency oscillator is fitted, you hear the "duck talk" of the signal.

The 10 kHz bandwidth of the radio means that on the ham bands, signals do overlap, but it also makes the broadcast stations sound better as most of them do broadcast with reasonable quality audio. Digital tuned AM radios are usually not suitable for the circuit as presented, because the tuning steps are 9 or 10 kHz apart and we want much smaller steps. The old manually tuned types of car radio are what you want.

The idea of the circuit is not to get too complicated, but to just enjoy listening on a simple, stable, cheap, short wave receiver. Experiment and enjoy!

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